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AGRICULTURAL ENGINEERING

MARCH · 1945

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Mow Curing of Hay with Forced Circulation of Air *B. A. Jennings*

Some New Designs of Soil Erosion Control Structures *F. W. Blaisdell*

New Fertilizer Distributor and Planter for Southern Farmers *G. W. Giles*

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THE JOURNAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

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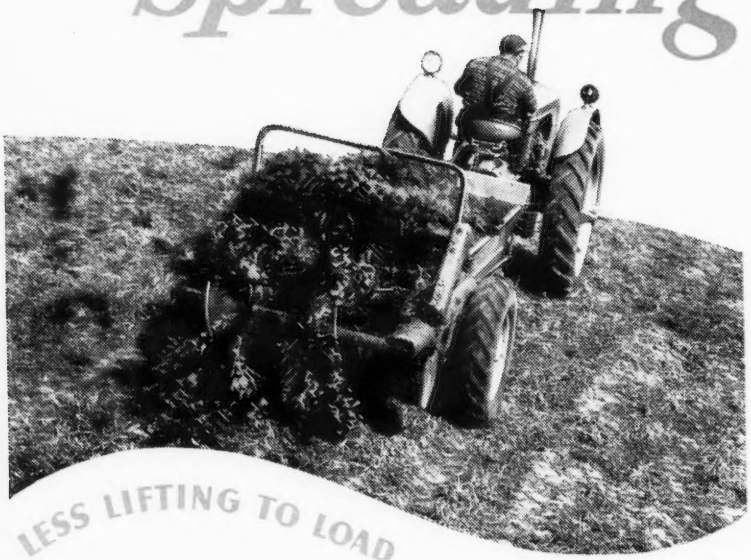

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AGRICULTURAL ENGINEERING

Established 1920

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EDITORIAL

Building vs. Buying

WALLACE ASHBY, in his specially prepared paper published as the leading article in this issue, has compressed momentous facts into a trifle over two pages. We strongly incline to believe that the key which can unlock a quarter-century stalemate in farm building is tucked away in the closing words of the first among his final points, "to obtain more building value per dollar."

From his chart (Fig. 3) it would appear that from 1920 through 1940 the investment per farm in implements and machinery has remained fairly constant. This seems surprising when we consider that this period embraced most of the transition from animal power to tractor power, with all the bigger and better implements which go with a tractor, and also included introduction of the combine into general farming. The paradox clears up when we consider the progress made by the farm machinery industry in reducing its prices, when the pricing is based on the capacity of power and machine to get things done.

So far as we can see, farm structures in general have achieved no such increase in units-of-utility per dollar of investment. If anything (taking a long-swing look rather than figuring from the postwar boom prices of 1920) there has been a rather steady trend for completed buildings to cost more and more per unit of utility. In consequence it has appeared to the farmer that he was getting more for his money in machinery than in buildings, and he has taken the obvious and economic course.

A farmer can buy a tractor but he can't buy a barn. He chooses the tractor because he really gets a tractor, not a mess of pig iron, steel bars, sheet metal and loose bolts dumped on his premises. Moreover, there are salesmanship and responsibility back of the tractor. Final price and functional performance are definitely assured. If and when he can get a similar deal and comparable value in a barn, we believe he will buy a lot of barns.

Let's Look at Production

MORE than two years ago, at the 1942 fall meeting of the American Society of Agricultural Engineers, a competent and hard-working committee made public a report on a practical plan for evaluating the worth of farm workers to the war effort. It set up not only the guiding principles but actual working forms for rating farmers in terms of the only thing that counts—production. Plenty of government men were present at that meeting, but the only outcome was that the report and its principles were completely and ostentatiously ignored.

Now, after two years, the military services demand that farms furnish more recruits and more food as well. Despite their double demands, the powers in charge of man-power policy still pay no attention whatever to rate of production in deciding what farmers shall be taken and who shall be left on the land. They may count the acres, but don't measure the yields. They may count cows, but without weighing the milk. Replaceability or its lack is the main criterion to induction or deferment, and again with little or no regard for the productive capacity of the replacement.

Glancing over the fence to adjoining fields we see the same sublime disregard for productive efficiency. While labor is borrowed from the Barbados Islands to break the serious bottleneck in foundry items, production by capable local workers is permitted to remain "pegged." Despite the risks of retribution which compel reticence, incidents do leak out wherein men in critical production are penalized by the price of one or several war bonds for daring to exceed daily or hourly limits.

All these things affect adversely the availability of machinery and man power for food production, and thereby interlock with agriculture and its engineering. Wherefore we once more urge that production volume be recognized as the only adequate criterion, not only in agriculture but in every essential occupation.

Meetings in Absentia

FOLLOWING announcement to members that the American Society of Agricultural Engineers would have no annual meeting this year, due to the government ban on gatherings of more than fifty persons, comes a suggestion from one of those members. From its spontaneity it might well reflect the ideas of other members, and we can say with more certainty that it is rather broadly in line with the thinking of the officers and Council of the Society.

He proposes that the machinery for the annual meeting be held pretty well intact and ready to function on short notice, should the fortunes of war take a sudden turn that would make a meeting possible. He hardly expects any need for a committee on local arrangements, but he urges that the program committee go ahead toward "business as usual." He would have speakers selected, subjects assigned, and papers prepared, all on the national level.

Actual presentation and discussion of papers, according to his idea, can be allocated to appropriate geographical sections or other more or less local groups within the Society. There should be definite arrangement to report significant discussion. Copies of papers might also be submitted to more distant members qualified to make pertinent comment. Finally edited and assembled for publication in these pages, he thinks, such papers and comment can serve as a creditable substitute for the technical phases of the annual and other national meetings.

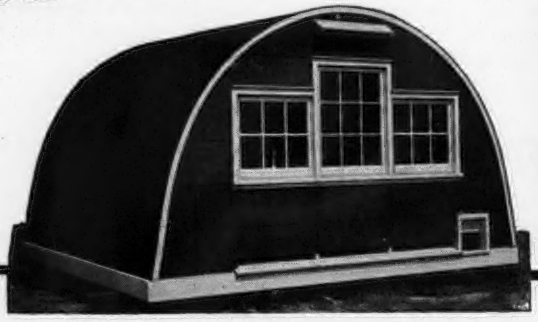
We share his view as to the desirability of sustained formulation and dissemination of our technology. We would even extend his proposal to include the preparation and discussion of papers, entirely by mail, for publication in these pages; that is, in cases where there is no meeting accessible for prompt personal presentation.

Royalty Road

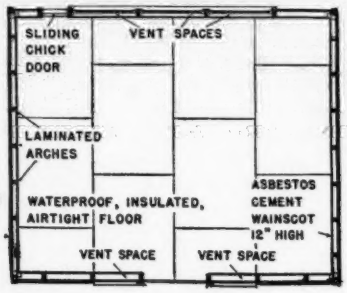
UNDENIABLY clever, the head of a well-known labor organization proposes to blaze a tangent trail across the American scene. While the world writhes in the parturient pangs of freedom reborn, he presses upon a primary industry of its principal producing nation a demand for a royalty on every ton of its production. He greases the point of his entering wedge by implying that the initial proceeds, at least, will be put to plausible purpose.

The possibilities of this precedent, if established, are simply fantastic. By a little collective bargaining of the "or else" brand our educators could levy a royalty on every academic degree, and create a fund for relief of improvident professors. We might even impose a royalty of a dollar or so on every mile of terrace-building, forming a fund for support of retired agricultural engineers. — W. B. JONES

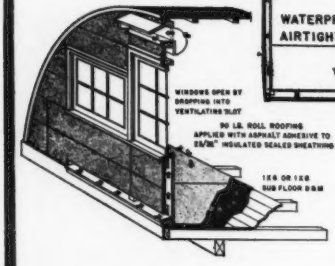
There are Two Ways of Looking at a BROODER HOUSE!



Arched roof construction saves cost, improves ventilation and adds strength and lightness. 90-lb. roll roofing is applied over ½" insulation board.



Floor plan of Flintkote designed brooder house


WINDOWS OPEN BY DROPPING INTO VENTILATING SLOT
90 LB. ROLL ROOFING APPLIED WITH ASPHALT ADHESIVE TO 25/32" INSULATED SEALED SHEATHING
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Detail of ventilating system

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AGRICULTURAL ENGINEERING

VOL. 26 MARCH, 1945 No. 3

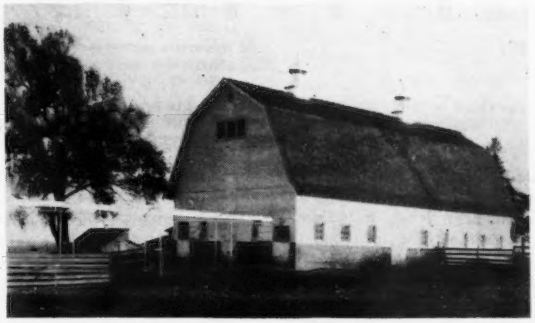
What's Happening in Farm Buildings?

Types, Values, and Relationship to Farm Economy

By Wallace Ashby

MEMBER A.S.A.E.

A GREAT deal of attention is being given by public service groups and industry to the place of farm buildings in our national economy and the need for solving farm building problems. Among those interested are: The north central regional committee on farm buildings set up by the directors of the state agricultural experiment stations of the region; the Rutgers Farm Buildings Institute, cooperating with the John B. Pierce Foundation; the interbureau committee on postwar planning of the U.S. Department of Agriculture and the cooperating state and regional committees; the Farm Structures Institute; the Producers' Council, through its agricultural committee; the American Home Economics Association, and the American Society of Agricultural Engineers.



Some of the questions under discussion are as follows:

1 What are the functional requirements of farm buildings?
2 How will farmers and the public benefit through buildings that meet functional requirements?
3 What volumes of construction are needed to repair and modernize present buildings and to build new ones?
4 What about the farm market for building materials?
5 How will farm construction affect postwar employment?
6 If the federal government underwrites minimum housing standards in urban areas, what will be its responsibilities in rural areas?
7 What are practical ways for the government to assist farmers in improving their buildings?

The accompanying charts* do not directly answer these questions, but they present information of interest to anyone studying the broader phases of farm building problems. Fig. 1, showing types of farm buildings and utilities, indicates the many purposes for which farm buildings are needed. While the farmhouse and the barn are most familiar, almost every farm also needs some buildings of other types.

Fig. 2 shows regions of similar farm housing requirements based on climate and type of farming. There are wide climatic differences between these regions. For example, in region G the average January temperature is about 10 F (degrees Fahrenheit) and minimum temperatures of −30 F or lower are not uncommon. There are less than five hours per day of winter sunshine and the annual snowfall is 40 in or more. Contrast this with region L where average January temperatures are above 50 F and there is practically no snow; with region A where the average winter temperature is above freezing but there are less than three hours per day of sunshine and heavy winter rainfall, or with region C-2 where there are seven to eight hours per day of sunshine and winter precipitation of only about 4 in. There are correspondingly wide differences in types of farming — dairying in region G, winter vegetable, fruit and other special crops in region L, mixed farming in region A, range livestock in region C-2. Build-

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

WALLACE ASHBY is head, division of farm structures, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

*The charts, with the exception of Fig. 2, were drawn by George L. Edick, chief draftsman, division of farm structures, BPISAE, USDA.

TYPES OF FARM BUILDINGS AND UTILITIES

FARMHOUSES	BUILDINGS FOR PRODUCT STORAGE	BUILDINGS FOR PROCESSING	BUILDINGS FOR EQUIPMENT AND SUPPLIES
Dwellings for: operators, retired parents, married relatives, workers with families.	Hay barns. Corn cribs: permanent, temporary. Granaries. Bins. Farm grain elevators. Silos: permanent above-ground, pit or trench, temporary. Vegetable storages: potato, sweetpotato, onion, cabbage and other farm and trackside. Fruit storages: apple, pear, orange, grape and other common and refrigerated. Frozen product storages. Ice houses.	Milk houses. Pasteurizing and bottling plants. Cheese factories. Smoke houses. Slaughter houses. Tobacco barns: air-, flue-, fire-cured. Forage dryers. Grain dryers. Fruit and vegetable packing houses, washing plants, dehydration structures.	Implement sheds. Garages. Farm shops. Fuel storages. Utility buildings.
BUILDINGS FOR LIVESTOCK	BUILDINGS FOR CROP PRODUCTION	MISCELLANEOUS STRUCTURES	FARM UTILITIES
Barns: general purpose, horse and mule, dairy, beef cattle, sheep and goat. Hog houses: movable, central, field. Poultry buildings: incubator cellars, brooder houses, range shelters, laying houses: movable, central battery. Small animal shelters. Exhibition buildings.	Greenhouses. Hotbeds. Cold frames.	Fences, walls and gates: corrals. Waterers. Self feeders. Dipping vats. Manure pits. Roadside stands. Tourist cabins.	Heating: orchards, buildings. Lighting. Ventilation: mechanical, gravity. Refrigeration. Waste disposal: dwelling, livestock, farm processing. Water supply: wells, cisterns, springs, pumps, windmills, hydraulic rams, storage tanks.

Fig. 1 Types of farm buildings and utilities

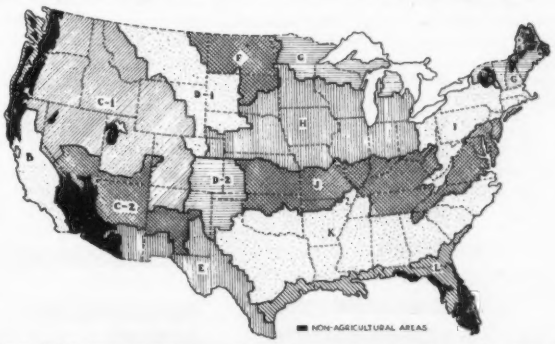
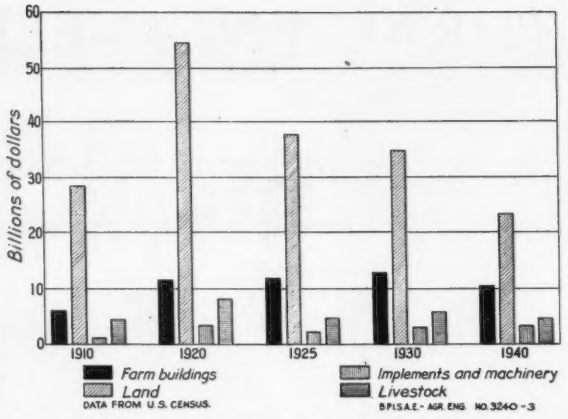


Fig. 2 Regional variations in farm housing requirements due to climate and type of farming: Region A, North Pacific forest, hay, and pasture region; Region B, Pacific subtropical crops region, plus Sierra Nevada portion of North Pacific region; Region C-1, northern grazing and irrigated crops and Columbia plateau wheat region; Region C-2, Arizona-New Mexico high plateaus; Region D-1, northern Great Plains region, excluding corn and spring wheat belts; Region D-2, western portion of hard winter wheat region, and part of Great Plains; Region E, lower and middle Rio Grande Valley and southern plateaus of New Mexico and Arizona; Region F, spring wheat belt; Region G, northern portion of dairy region; Region H, corn belt and southern portion of lakes states dairy belt; Region I, eastern portion of dairy belt, excluding colder northern sections; Region J, corn and winter wheat belt, including eastern portion of hard winter wheat belt; Region K, cotton belt; Region L, humid subtropical crops belt. (From USDA Misc. Pub. No. 322, "Housing Requirements of Farm Families in the United States")

ing design must of course be modified to meet these regional differences and this adds to the variety of buildings required.

Fig. 3 shows the values of farm buildings, land, implements and machinery, and livestock for the United States from 1910 to 1940. In 1910 the value of buildings was about 6 billion dollars and amounted to only 20 per cent of the value of land. The value of both land and buildings jumped in 1920 but the proportions stayed about the same. From 1920 to 1940 the value of land declined but the value of buildings remained almost the same, so that in 1940 the value of the buildings was almost one-half that of the land. Changes in value of buildings and land were due mostly to changes in the price level; if buildings are valued in 1910 dollars as in Fig. 4, it may be seen that the physical volume of farm buildings has been declining since 1920 and in 1940 was only slightly greater than in 1910.



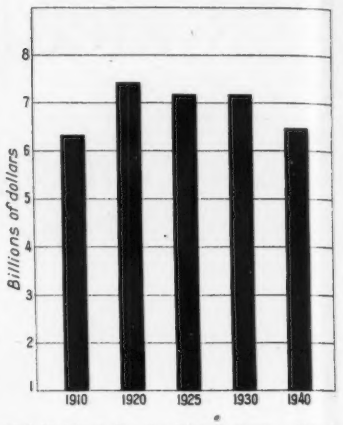


Fig. 3 (Left) Value of farm buildings, land, implements and machinery, and livestock for the United States, 1910 to 1940 (From U S. Census) • Fig. 4 (Right) Farm building values in 1910 dollars (From U. S. Bureau of Agricultural Economics, "Income Parity for Agriculture", part II, sec. 5, corrected to 1943)

Fig. 5 shows estimated expenditures for and depreciation of farm buildings, fences, windmills, and wells from 1910 to 1943. Expenditures ran higher than depreciation in the years from 1910 to 1919, but from 1920 until 1936 depreciation considerably exceeded expenditures. In 1939, 1940 and 1941 expenditures were greater than depreciation, but in 1943, with scarcities of building materials and labor, expenditures again fell below depreciation and no doubt were even farther behind in 1944. With the backlog of overdue building that has accumulated and the improved financial position of many farmers, it is expected that as soon as materials and labor again become available there will be a large increase in expenditures for farm building improvements.

Fig. 6 shows estimated percentages of man hours worked in and around buildings to produce various crops and livestock. In Fig. 7 these percentages are used in connection with data from USDA Bureau of Agricultural Economics Mimeograph F.M. 40, "Labor Requirements for Crops and Livestock", to show the total number of man-hours worked in and around farm buildings in 1943. Note the immense total of more than 7 billion man-hours of work in and around farm buildings. Much of this work could be eliminated with proper design of buildings and farmsteads. Certainly it should be possible to save a billion man-hours of this time each year. What other postwar program offers this possibility?

Fig. 8 shows the percentages of gross farm income spent on farm buildings by farmers. This is calculated from the data of Fig. 5 and published Bureau of Agricultural Economics figures on farm income. From 1915 to 1920 expenditures for farm buildings averaged about 5 per cent of gross farm income, then gradually declined

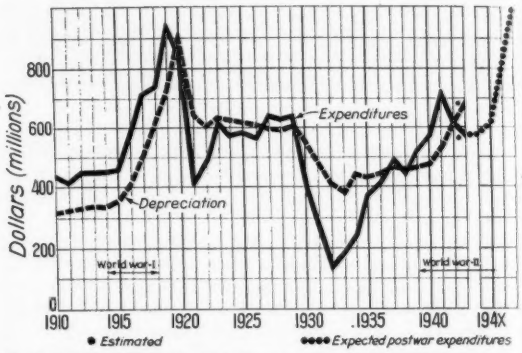
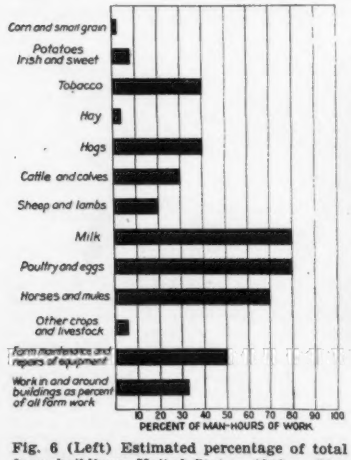


Fig. 5 Expenditures for and depreciation of farm buildings, fences, windmills, and wells in the United States, 1910 to 1943 (From USDA Bureau of Agricultural Economics, "Income Parity for Agriculture", part II, sec. 5, corrected to 1943)


Corn and small grain
Potatoes Irish and sweet
Tobacco
Hay
Hogs
Cattle and calves
Sheep and lambs
Milk
Poultry and eggs
Horses and mules
Other crops and livestock
Farm maintenance and repairs of equipment
Work in and around buildings as percent of all farm work
10 20 30 40 50 60 70 80 90 100
PERCENT OF MAN-HOURS OF WORK

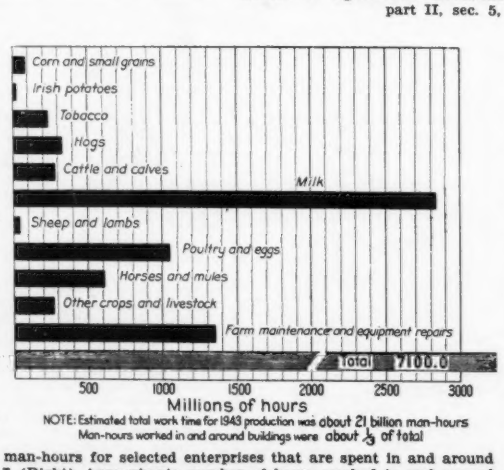

Corn and small grains
Irish potatoes
Tobacco
Hogs
Cattle and calves
Milk
Sheep and lambs
Poultry and eggs
Horses and mules
Other crops and livestock
Farm maintenance and equipment repairs
Total 7100.0
500 1000 1500 2000 2500 3000
Millions of hours
NOTE: Estimated total work time for 1943 production was about 21 billion man-hours
Man-hours worked in and around buildings were about 1/3 of total

Fig. 6 (Left) Estimated percentage of total man-hours for selected enterprises that are spent in and around farm buildings, United States, 1943 • Fig. 7 (Right) Approximate number of hours worked in and around farm buildings in production of farm products, United States, 1943 (The author is indebted to M. R. Cooper, division of farm management and costs, Bureau of Agricultural Economics, USDA, for assistance in the preparation of Figs. 6 and 7)

until in 1932 they amounted to only 2¼ per cent, rose in 1940 and 1941 to 5¼ per cent, and dropped in 1943 to about 2½ per cent. By way of contrast the chart shows that from 1932 to 1944 the federal funds spent on farm building research, including funds allotted to state agricultural experiment stations, amounted to only one-sixth to one-half of one per cent of total federal expenditures for agricultural research. Federal expenditures for farm building investigations in the 1944 fiscal year were less than 1½ cents per farm, while expenditures by farmers for building improvements were close to $100 per farm.

In proportion to income, farmers are spending much less than city people for buildings. It is

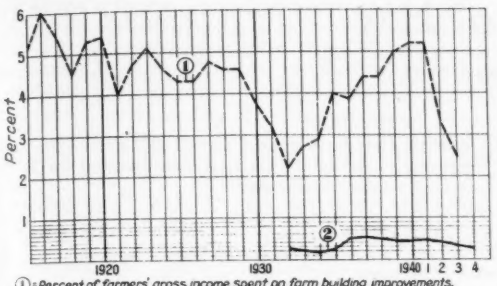

Percent
6
5
4
3
2
1
1920
1930
1940 1 2 3 4
① Percent of farmers' gross income spent on farm building improvements.
② Percent of federal appropriations for agricultural research alloted for farm structures investigations. (Includes allotment of federal-grant funds to states).
1944 FEDERAL EXPENDITURES FOR FARM BUILDING INVESTIGATIONS ARE LESS THAN 1½ CENTS PER FARM.
FARMERS 1943 EXPENDITURES FOR FARM BUILDINGS AVERAGED $95 PER FARM.

Fig. 8 **Percentages of gross farm income spent on farm buildings by farmers and of federal research appropriations spent on farm building research by research agencies**

generally considered that the average city family spends 15 to 25 per cent of its income for housing, but the available data indicate that from 1915 to 1943 farmers spent an average of less than 5 per cent of their *net* income for housing, and less than 10 per cent of *net* income for all buildings, fences, wells and windmills. The percentages for city and farm are not exactly comparable, however, since the farm figures do not include interest charges and insurance on buildings.

We must assume that farmers have been spending as much as they think buildings are worth in proportion to other goods and services. But what would they be willing to pay for improved types of farmhouses and other buildings that would cut chore time, eliminate most of the 100-million-dollar annual farm fire loss, greatly reduce shrinkage and damage to fruits, vegetables and grains in storage, improve the quality and feeding value of hay, increase milk and egg production, save an average of eight pigs per litter instead of six, and provide cleaner, pleasanter and more comfortable living and working conditions all around the farmstead?

These ideal farm buildings will not just happen along. To get them the following steps are needed:

1 Adequate research to determine the functional requirements for each type of building, to find means of reducing man-hours of labor, to test structures developed to meet new and higher standards, and finally to obtain more building value per dollar.

2 An expanded extension program to carry information about better structures to farmers and to give them competent advice about repairing and modernizing their present buildings.

3 Teaching and vocational training to prepare research and extension workers and to acquaint country carpenters, contractors and materials dealers with new developments.

4 A system of financing building improvements as well suited to the farm as FHA loans are to the city.

Economics of Processing Animal Feeds by Mechanical Dehydration

By Paul DeLeon

WHILE a great deal of experimental and development work has been done on equipment for harvesting of certain crops, very little has been done on processing or drying them. That is where the dehydrator comes into the picture, and the most important factor to be considered is the economics. Can we afford to process these feeds mechanically? I am thinking principally of the sweet potato for carbohydrates in the southern or sweet-potato-growing territory.

Our company has installed three test plants for animal feeds — one in Wisconsin, another in Georgia and another in North Carolina. We have been most successful with our human food dehydration plants, having installed one which is the largest sweet potato dryer in the world. Our animal food plants are designed around well-known engineering principals by combining these proven economics.

In the case of sweet potatoes, it is necessary that the farmer make a legitimate profit on his crop. The processor is entitled to a legitimate price for his processing; the ultimate price for his product will be governed by the competitive product which will probably vary between $1.25 and 70c per bushel. One of the big problems in connection with mechanical dehydration is the use factor or the length of time in a year the plant can be operated. This makes it necessary to have a so-called universal plant, one which will handle all of the crops. As an illustration of this, a plant which would produce 3,000 tons of dry material a year would probably have a cost of $6.60 a ton; while for the same plant producing 6,000 tons, the cost would be reduced about $1.10 a ton.

The products to be handled must be thought of in terms of chemical components, yield per acre and the cost of growing, allowing the farmer a fair profit. Also the cost of harvesting and the cost of producing and the value of the finished product against competitive products. It is evident that each plant will present different problems on account of the local crops; therefore, the competitive angle must also be studied. To give a slight idea as to the difference in operation of these various plants, assuming a one-ton-per-hour finished product as to size, costs will vary between $30,000 and $40,000. The fuel cost in relation to locations will run between $1 and $3 per ton. The power cost will be 75c to $1.50 and labor from $1 to $3. As to the ultimate cost of the material, it will probably be the same in all parts of the country. This will automatically fix the price of the material on raw products which the farmer will receive.

There are approximately nine different methods of applying heat for drying purposes. There is conduction, convection, radiation, delectric heat and induction heat and combinations of all of these. We found it necessary to study carefully the critical temperature of the product, the time element, the surface of the products to be heated and the type of finished product, whether it should be a flour, a meal or a kernel.

Some experiments have been carried on the past six months as to the ultimate moisture content of the product. In some sections of the country, it is necessary to store the products with a moisture content of 6 to 7 per cent. In other parts of the country 9 to 10 per cent, and other sections run from 10 to 12 per cent. Therefore, it is evident that it is a waste of money to dry a product to 6 and 7 per cent, put it in storage and have it rise to 10 to 12 per cent moisture.

The plant in Perry, Georgia, which was in operation on sweet potatoes this past fall in sufficient quantities to arrive at costs, produced meal from culls and roots of the Puerto Rico potato with a moisture content of around 70 to 74 per cent and an ultimate of 8 to 10 per cent with a capacity of 2250 lb per hour. A fuel cost of $1.50, power cost of $1.15, labor cost of $1.25, miscellaneous 20c, and bags $1.65, making a total product cost of $5.75 per dry ton. This particular unit is coal fired. Coal costing $6.60 per ton for 12,000 Btu heat value was used.

One of the problems to be considered in installing a plant of this type is whether it should be located in the territory where potatoes would be brought to the sorting house, graded, and only the culls and roots dehydrated, or whether to plant nothing but the Jumbos for complete dehydration. My own opinion is that it should be a combination of both, as well as sufficient legumes available for continuous operation during the harvest seasons.

From an analysis of the foods produced by dehydrator, sweet potatoes have a 95 per cent equivalent food value of corn. From the requests which we have had from feed producers, they are interested in the product for both dairy and feeder stock, poultry feed, and also to be used as a filler in their concentrates.

This paper was presented at a meeting of the Southeast Section of the American Society of Agricultural Engineers at Atlanta, Georgia, February, 1945.

PAUL DELEON is chief engineer and manager, food processing division, Cleaver-Brooks Co.

Mow Curing of Hay

By B. A. Jennings

MEMBER A.S.A.E.

THE curing of hay in the mow by the blowing of air through the hay has aroused the interest of many farmers. To obtain additional information on the principles underlying mow curing, the research work described in this paper was undertaken at Cornell University as a part of a general hay research project.

In order to obtain accurate information, three bins of hay (Fig. 1) were operated at the same time so that all the factors affecting the curing of hay, except one, were held as nearly constant as possible to permit comparison of results. Since this procedure is almost impossible to carry out with an actual installation, laboratory equipment was used. Every effort was made to make this laboratory equipment similar to actual conditions so that the results could be utilized for additional field research.

Equipment Used. Six bins, 4 by 6 ft and 4 ft high were constructed of plywood. These bins were made so that additional and interchangeable tops could be added to obtain a height of 8 or 12 ft. The tight sidewall and the 4-ft width gives conditions similar to that found in the center of a mow where the laterals are placed 4 ft apart and where the air travels normally straight up through the hay.

A flue 5.5 by 10.25 in in cross section extends the length of these bins to deliver air similar to a mow installation.

Each bin was equipped with an individual fan driven by a ¼-hp electric motor. The fan is a standard multivane, No. ½, manufactured by the Clarage Fan Company, and is capable of delivering from 180 to 720 cfm of air at a static pressure up to 1½ in of water. V belts and suitable pulleys provide the means of obtaining the desired fan speed and thus the desired amount of air.

The motor, fan and connecting flue can be removed as a unit to permit weighing the bins. A slip joint with rubber gasket made a tight connection to the main flue.

A hoist with suitable tackle was used for the raising and lowering of the bin and contents. Two portable platform scales, one at each end, were used for weighing the entire bin and its contents to determine loss of weight and percentage of moisture.

The method of procedure in conducting these tests was as follows:

1 *Loading of Bins.* To prevent air pockets, the hay was loaded into the bins in small forksful, and was packed along the sides as it was loaded to prevent air leakage up the sidewalls. When nearly full, the edges were trapped then refilled.

2 *Moisture Samples.* A composite sample for moisture determination was taken while loading the bins. Immediately after loading, the hay samples were chopped and mixed and the required final sample was weighed and placed in a drier. A similar sample was taken when the bins were unloaded at the end of the test.

3 *Weighing.* The hay was weighed as soon as the bins were loaded — twice a day during the test and when unloaded at the end of the test. The weighing was done at approximately 7:00 a.m. and 7:00 p.m., or at 6 o'clock, Eastern Standard Time.

4 *Average Moisture.* The average percentage of moisture for each weighing period was determined from the percentage of moisture and the weight at loading time.

5 *Amount of Air.* The amount of air delivered to the bins was determined by two methods: first, by a pitot tube in the flue and, second, by an anemometer with a restricting cover on top of the bin.

6 *Temperature and Humidity.* Room temperatures and relative humidity were obtained for the entire period with recording equipment. Temperatures throughout the bins were obtained for some of the tests with resistor thermometers.

7 *Quality of the Hay.* The quality of the hay was judged by inspection. Because of the lack of an adequate yardstick, quality between different runs could not be compared unless there was a considerable difference.

Thirteen runs were completed during the summer as shown in Table 1.

The six objectives studied, some of which were repeated, while others were run only once, are as follows:

1 To determine the effect of the percentage of moisture of the hay on the rate of curing.

2 To determine the effect of various amounts of air on the rate of curing.

3 To determine the effect of time of blowing on the rate of curing of the hay and to compare continuous blowing with various combinations as controlled with a time clock.

4 To compare the effect of different methods of harvesting on the rate of curing.

5 To determine the effect of additional loading on the rate of curing.

6 To determine the effect of auxiliary heat on the rate of curing.

Fig. 2 for Test No. 7 shows a typical curve for the amount of air.

OBSERVATIONS

Some of the conclusions from the 1944 tests, which are of course based on only one year's work may be proven erroneous as additional tests are completed. Also, the more promising results obtained with the laboratory equipment should be checked under field conditions for confirmation.

1 The quicker hay is dried, the greener will be the color of the finished product. This was especially noticeable in Test No. 13 using auxiliary heat. It was also evident in the other tests by comparing the color of the hay at the bottom of the bin with that at the middle or top. The bottom part which dried first was considerably greener in color than the rest of the bin.

2 The higher the moisture content of the material at loading, the greener the color of the hay. Hay loaded at 40 per cent moisture was paler and a lighter green than hay loaded at 50 to 65 per cent. The clover leaves also were not as dark brown from material having a higher moisture content.

3 Mow-cured hay appears to have a higher percentage of moisture than field-cured hay of the same moisture content. The reason for this may lie in the fact that field-cured hay is normally dry on the outside and the moisture is largely on the inside of the stems. With mow-cured hay the moisture is probably more uniformly distributed. Fairly low moisture mow-cured hay feels damp or even wet.

4 The temperature of hay while curing is below the temperature of the air from the fan. This is due to the vaporizing of the moisture. As the curing process nears completion the temperature of the hay approaches or equals the room temperature.

5 The amount of temperature drop varies with the moisture content of the hay, the amount of air and the humidity of the air. In other words, the more evaporation that takes place, the cooler the hay temperature will be.

6 There is no danger of the hay heating in mow curing, since the cooling action of evaporation prevents any rise in temperature so long as there is sufficient air

Fig. 1 This shows the plywood bins used in the Cornell Research studies of mow curing of hay

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

B. A. JENNINGS is professor of agricultural engineering. Cornell University.

and so long as the hay is properly distributed, so that the air travels through the hay uniformly. If the hay is improperly distributed, so that there are air leaks in spots, or if the hay is tramped so that the density is too great in places, the air will seek an easier path and heating may result in the more dense spots.

7 Increasing the amount of air increases the rate of curing, or it decreases the time required. In four different tests, increasing the air up to 26 to 30 cfm per sq ft did not materially decrease the efficiency of blowing. Increasing the amount of air will decrease the possibility of mold, or it will permit heavier loadings, or the moisture content of the hay can be higher at loading.

8 The amount of air required and the fan size should be based on the amount of water in the load rather than on the area of the mow floor. The amount of water in the load will depend on two factors, the percentage of moisture of the hay and the depth of the loading.

9 Hay with a high moisture content will dry even when the air has a high relative humidity. The charts from the tests having continuous blowing show almost a steady decline in the percentage of moisture during the night, and it requires severe weather conditions to flatten out the drying curve.

10 Hay will not take on moisture when the relative humidity of the air is high, unless the hay is well below the safe-keeping stage. In the tests, there was no increase in the weight of the hay during the night with continuous fan operation until the hay was below 13 per cent average moisture content. Where a second loading of hay is placed on top of some hay that is cured, the cured hay may take on moisture, but this factor should help in curing the upper part, and later the lower or cured hay should again give up this moisture.

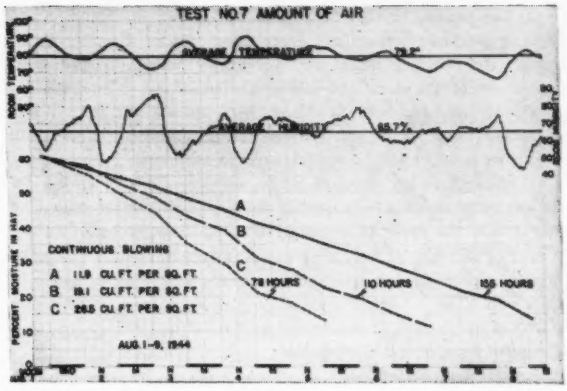

TEST NO.7 AMOUNT OF AIR
CONTINUOUS BLOWING
A 11.9 CU. FT. PER SQ. FT.
B 19.1 CU. FT. PER SQ. FT.
C 28.5 CU. FT. PER SQ. FT.
78 HOURS
110 HOURS
155 HOURS
AUG. 1-9, 1944

Fig. 2 A typical curve for the amount of air from data from test No. 7 (Table 1)

11 Continuous blowing is better than other methods studied for controlling the fan. This is especially true when a heavy load of high-moisture-content hay is being cured. Even at night when humidity conditions are high, blowing will continue to evaporate moisture from such hay. It is true that the efficiency of the drying value per cubic foot of air is not as good at night as in the daytime, but the increase in hours of operation may be offset by the extra gain in time saved and by preventing the growth of molds. Since the cost of the blowing is largely due to overhead, the additional power costs will not be excessive.

TABLE 1. SUMMARY OF TESTS ON THE MOW CURING OF HAY, 1944

Objective	Date of test	Ave. temp., F	Ave. humidity, per cent	Material at loading: Material	Maturity	Water, %	lb/cu ft*	Depth, ft	Cfm/ sq ft	Fan operation: Hours off	Hours on	Hours to 20%	Total hours fan on	Material at unloading: Water, %	Condition of hay
Amount of air	July 21 No. 5	74	67	Clov. mix. 1st	Late	55	5.5 5.4 5.6	4	15 21 28	7-7:30 a.m. 7-7:30 p.m.	23	108 85 68	103 82 65	10 10 11	Good quality Good quality Good quality
	Aug. 1 No. 7	79	66	Alf. mix. 1st	Very Late	61	5.8 6.0 5.9	4	12 19 27	7-7:30 a.m. 7-7:30 p.m.	23	155 110 78	149 105 75	17 12 11	15% moldy Good quality Good quality
	Aug. 9 No. 10	81	65	Clov. mix. 2nd	Early	47	6.0 6.4	4	10 20	7-7:30 a.m. 7-7:30 p.m.	23	107 65	103 62	17 14	Good quality Good quality
	Aug. 17 No. 11	72	59	Clov. mix. 2nd	Med.	55	7.2 7.1 7.6	4	13 18 21	7-7:30 a.m. 7-7:30 p.m.	23	102 84 73	98 81 70	15 12 12	Odor of mold Good quality Good quality
Per cent of moisture at loading	June 26 No. 1	76	69	Clov. mix. 1st	Early	80 73 67 48	14.6 13.6 11.6 8.0	4	11±	7-7:30 a.m. 7-7:30 p.m.	23	192 240 264 168		No Test Made	85% moldy 85% moldy 80% moldy 75% moldy
	July 7 No. 3	76	69	Clov. mix. 1st	Med.	61 50 42	8.2 8.1 5.6	4	11±	7:30 a.m. 7:30 a.m.	12	240 167 123	120 84 62	16 4 11	85% moldy 35% moldy 1% moldy
	Aug 8 No. 9	81	64	Alf. mix. 2nd	Med.	67 63 55	9.0 8.8 7.5	4	11 10 14	7-7:30 a.m. 7-7:30 p.m.	23	208 173 112	200 166 107	20 18 10	70% moldy 60% moldy 1% moldy
Time of blowing	July 3 No. 2	78	69	Clov. mix. 1st	Med.	40	5.9 6.4 6.2	4	11±	Thermo-stat 9-6:00 cont.	14 23	159 110 77	65 74	14 14 12	20% moldy 15% moldy Good quality
	July 24 No. 6	75	69	Alf. mix. 1st	Late	47	5.5 5.4 5.7	4	11±	1.5 off† Tenn.‡ cont.	12 14 23	117 89 77	61 52 74	16 11 10	1% moldy Odor of mold Good quality
	Aug 1 No. 8	79	69	Alf. mix. 1st	Very late	58	4.9 4.5 4.9	4	20 22 20	6-12:00 Tenn.‡ cont.	17 14 23	131 130 117	93 76 112	12 12 11	Good quality Good quality Good quality
Method of harvesting	July 12 No. 4	70	66	Chopped crushed long	Med Clov. 1st	52 60 61	6.9 7.3 7.2	4	9 13 18	7:00 p.m.-7:00 a.m.	12	186+ 263+ 283+		17 22 27	100% moldy 40% moldy 50% moldy
Additional loadings	Aug 21 No. 12	69	59	Clov. mix. 2nd	Med.	48 62 56 61		2 2 2 2	11	7-7:30 a.m. 7-7:30 p.m.	23	142	136	15	All loading good quality
Use of heat	Aug 23 No. 13	67	56	Clov. mix. 2nd	Late	56	6.3 6 4	4	13 17	7-7:30 a.m. 7-7:30 p.m.	23	98 65	94 57	16 14	Good quality Very green Brittle

*Density at loading. †1.5 hr on. 1.5 hr off. ‡Off. 9:00 p.m. to 1:30 a.m. and from 2:30 a.m. to 7:00 a.m.

12 The heating of hay while the fan is not in operation apparently produces a limp and dense mass causing difficulty in air travel. The sweating action may also allow moisture to gather on the outside of the stems and leaves, thus resulting in an increased growth of mold and bacteria. In all of the tests where the hay was allowed to stand before the fan was started and where temperature of hay went up to 100 F, serious molding occurred.

13 Molding of hay is permitted by too slow a rate of curing. If the hay remains for a long time at the low temperatures caused by evaporation, the mold will increase until spoilage occurs.

14 The molding and decay of hay is one of the bigger problems in mow curing. In fact, it is the one item which must be seriously considered. The noticeable odor accompanying mow-cured hay may be due to the growth of molds and bacteria although they may not be evident from casual observation.

15 Spot molding of hay in an otherwise satisfactory mow is probably due to incorrect air travel. This may be caused by air leakage or it may be caused by the mass being too dense in spots due to tramping in mowing.

16 Air leakage at the sidewalls and posts and at the mow floor can be controlled by tramping the material to make it more dense at these places. Proper mowing of the hay will result in uniform air travel.

17 Chopped, crushed or fine hay must be lower in moisture content than coarse whole hay for an equal rate of curing. Since the fan output decreases with the static pressure, anything which tends to make the mass of hay more dense decreases the amount of air and consequently slows down the rate of curing.

18 Alfalfa hay apparently gives better results in mow curing than does clover hay. This is especially true when judging quality by the color of the hay. Alfalfa remains a fairly bright green color even under a slow rate of curing. Clover hay, on the other hand, must have a fairly high moisture content at loading and must be dried or cured rapidly or the leaves will turn brown or black in color.

STUMPDOZER HELPS IN RECLAIMING RESINOUS PRODUCTS FROM YELLOW PINE STUMPS

The "stumpdozer" shown in these pictures, mounted on a Caterpillar tractor, has made it possible to reclaim valuable resinous products — turpentine, pitch, tar, and resin — from yellow pine stumps that had been left in the ground to rot because there was no efficient way to remove and utilize them. The steel castings for the stumpdozer had to be specially made. The splitter, shown in the upper left view, piercing a stump, is about 6 in square with a chisel point on the front; and to make the cutter wear longer, welding beads are used on the sides. Two prongs, shown in the upper right and lower left views, pry under the stump to uproot it. The equipment shown here, in operation near Morgantown, Miss., pries out 16 to 18 tons of stumps per hour. The stumps are then hauled to a nearby naval stores distilling plant where much-needed turpentine and other resinous products are reclaimed. Farmers have benefited from this brand of "land reclamation" by receiving 25c per ton for the stumps and having their land cleared for cultivation. A partial view is shown (lower right) of the 1,000 acres on the farm of V. A. Anderson in Mississippi formerly covered by yellow pine trees and stumps, that were cleared within a year by tractor and stumpdozer.

The Design of Soil Erosion Control Structures

By Fred W. Blaisdell

IN THIS paper no attempt will be made to cover all the recent developments made by the Soil Conservation Service, but only those structures that have been studied and are still being studied at the St. Anthony Falls Hydraulic Laboratory. These include pipe bleeders, rectangular spillways, flume outlets, culvert outlets as they have been constructed, and a new and less expensive type of stilling basin. A few additional studies have been made on specific structures.

On January 1, 1940, the Soil Conservation Service in cooperation with the Minnesota Agricultural Experiment Station established a project at the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota in Minneapolis to conduct research in conservation hydraulics. The project was established at the request of the Upper Mississippi Valley regional office of the SCS which recognized the need for additional information on certain methods of controlling erosion and disposing of surplus runoff. Since the project was established, we have attempted to answer many of the questions presented by the engineers of the region. The structures we have developed have been principally for the states in the Upper Mississippi Valley. These now include the states from Ohio to Iowa and from Missouri to Minnesota. However, we have not lost sight of the national problem and have attempted to make our results generally applicable throughout the United States.

Our first assignments were to study structures already in use. Through these studies we have reliably determined the hydraulic capacity, discovered the structures' weak and strong points, and modified and improved the structures as a whole. Some of the weaknesses, particularly in outlets, have been so serious that we have been compelled to recommend that use of the structure be discontinued. These weaknesses were recognized by the men responsible for the design and construction of the structures, and they were the ones who first asked for the establishment of the Minneapolis project. For these structures we have developed, and are still developing, satisfactory substitutes.

Many perhaps think of models as representing some particular field installation. Models of this type will always be built and tested. We do some work of this type, but only on the most important structures and to solve the most difficult problems. The fact will be recognized that it would not be economical to make a model of each structure built to control erosion — probably some of the models would cost as much as their prototypes. For this reason we are conducting most of our studies in such a way that the results can be applied to any field location without making additional model studies. With this method it takes us longer to arrive at the answers to the problems, but subsequent to the completion of the generalized model study, a structure can be designed for a wide variety of field conditions without recourse to further model studies.

Pipe Bleeder. The first type of structure to be discussed in this paper is known as a pipe bleeder. Pipe bleeders are used to drain off or to "bleed" water from ponds located on small watersheds. They may be considered as small drop inlet culverts and are used for the same purposes. They consist of an inlet and a pipe laid through the dam. The pipe may be laid on a steep slope. By this I mean a slope steeper than that of the hydraulic grade line, and in this case we have been assuming that the barrel would not flow full of water. This means that the head forcing water through the structure is a depth over the inlet. If the pipe can be made to flow full of water, the head will be the difference between the elevation of the water surface in the pond and the elevation of the pipe outlet. This much larger head will permit a much smaller pipe to carry the same amount of water. Our problem is to make the pipe bleeder flow full and to determine the flow through pipe bleeders.

We have found that pipes laid on slopes as steep as 30 deg will flow full of water. Present indications are that it is necessary to attach a riser to the upstream end of the pipe. The riser should have a cross-sectional area somewhat larger than that of the pipe and a depth of several pipe diameters. We are unable to present any definite conclusions or recommendations at the present time. The study is now dormant due to lack of personnel, but it will be resumed at the earliest possible opportunity.

Rectangular Spillways. We have completed a study of rectangular spillways as we have chosen to call this type of structure. Other names, commonly used, are U-type entrances, drop boxes, or head spillways. A rectangular spillway (Fig. 1) consists of a rectangular box open at the top and at the downstream end. Water flows into the box over the three sides and out through the open end. The rectangular spillway is used at the entrance to flumes and at the head end of gullies where a long crest length is required. A typical field installation is shown in Fig. 2.

We have recently released a bulletin, entitled "The Hydraulic Design of Rectangular Spillways," which quite thoroughly covers the subject matter indicated in the title. We shall be glad to send copies to those who wish it.

Rectangular Spillway Outlets. After completing our work on rectangular spillway entrances, we directed our attention to the outlet. We have completed the first phase of the studies and have developed a satisfactory outlet (Figs. 3 and 4). However, we feel that there are locations where a much smaller outlet can be used than the one we now have. We know we can develop such an outlet and studies to achieve this end are now being made.

Flume Outlet. Some time ago we were asked to develop an outlet to be used at the end of a flume. Fig. 5 shows a stilling basin of this type located in Taintor Township, Wisconsin. The flume is 6 ft wide and the blocks are 1 ft high. (The blocks in the stilling basin are used to break up the entering stream, and the end wall forms a pool in which the energy of the water can be dissipated.)

Fig. 6 is a view of the downstream end of the stilling basin shown in Fig. 5, after a storm in which the discharge was about

This paper was presented at the annual meeting of the American Society of Agricultural Engineers at Milwaukee, Wisconsin, June, 1944, as a contribution of the Soil and Water Division.

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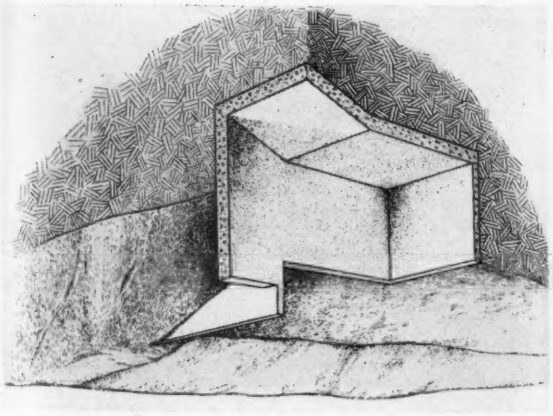


Fig. 1 Drawing showing construction of a rectangular spillway

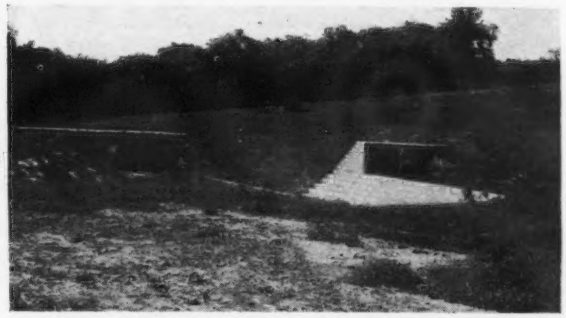
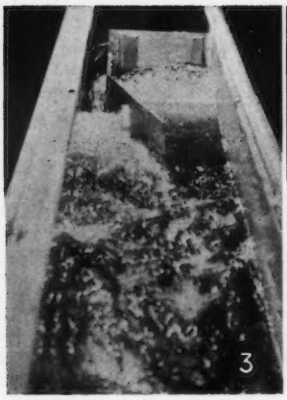


Fig. 2 Typical installation of a rectangular spillway



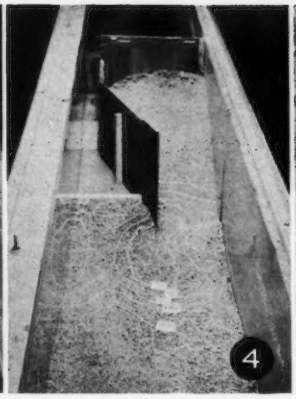


Fig. 3 A half model showing one of the rectangular spillway outlets in action • Fig. 4 The same model outlet, as in Fig. 3, showing the resulting erosion

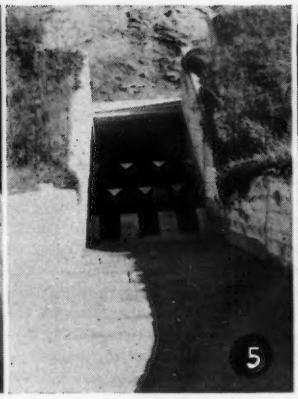


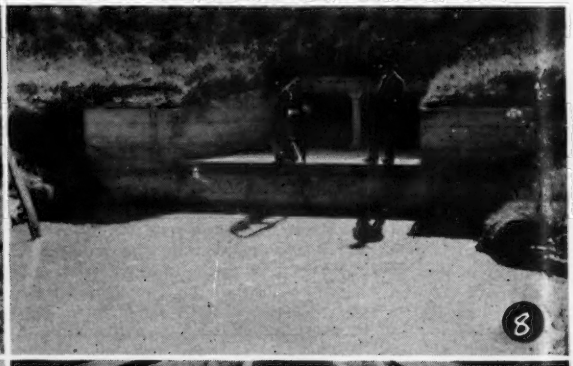
Fig. 5 The stilling basin of a flume outlet • Fig. 6 The down-stream end of the stilling basin shown in Fig. 5

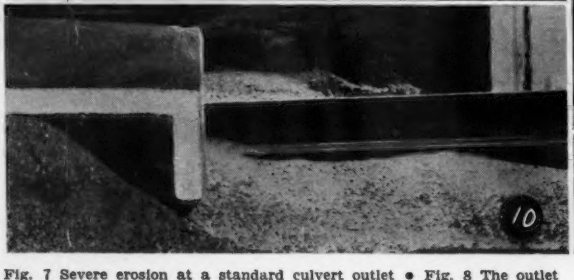
equal to the design capacity of the structure. The lack of erosion is very noticeable in this picture.

Standard Culvert Outlet. Severe erosion has occurred at many of the outlets used in conjunction with standard drop inlet culverts. Fig. 7 shows a culvert outlet built in 1933. The culvert is 2½ ft square and the total drop is 30 ft. The cutoff wall has been completely exposed and the side of the gully at the right of the picture has been severely eroded. Fig. 8 shows the outlet end of a twin 4-foot-square drop inlet culvert. A pool of water hides much of the erosion, but 5½ ft have been removed from the stream bed at the end of the outlet.

During our studies to improve the standard culvert outlet we duplicated in the laboratory the erosion at these outlets. Fig. 9 shows a model drop inlet culvert that has been split on its centerline and pressed against the glass side of the test channel so we could observe its erosion better. The erosion at the end of a test run is shown in Fig. 10. Note how the cutoff wall has been undermined.

SAF Stilling Basin. Our tests on the standard culvert outlet showed the necessity for discovering a new outlet. A model of the SAF outlet developed at the St. Anthony Falls Hydraulic Laboratory is shown in Fig. 11. It bears some resemblance to the flume outlet shown previously, but it is based on more tests, is smaller and is more efficient. It can be used *(Continued on page 110)*





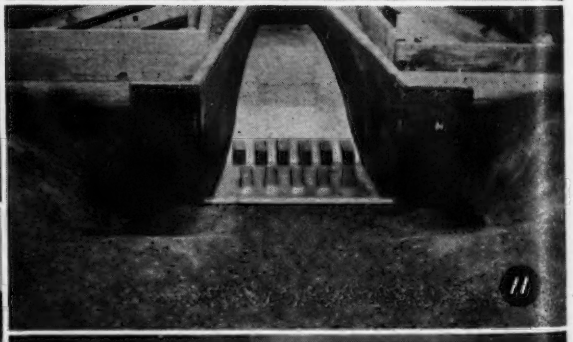


Fig. 7 Severe erosion at a standard culvert outlet • Fig. 8 The outlet end of a twin 4-foot-square drop inlet culvert • Fig. 9 A model drop inlet culvert outlet • Fig. 10 Erosion resulting from a test run on the model outlet shown in Fig. 9 • Fig. 11 A model of the SAF culvert outlet • Fig. 12 This shows the action of the stilling basin of the SAF culvert outlet

A New Fertilizer Distributor and Planter for the Southern Farmer

By G. W. Giles
MEMBER A.S.A.E.

THE SMALL southern farm is perhaps the least efficiently mechanized unit in the entire farming industry of the United States. Take, for example, the case in North Carolina where approximately one-half of the total farms have fewer than 20 acres in cultivation, four-fifths have fewer than 10 acres in cotton, and two-thirds have fewer than 10 acres in corn. On these farms it takes approximately 150 man-hours to grow and harvest one acre of cotton and approximately 50 man-hours to grow and harvest one acre of corn.

This inefficiency has persisted largely because of the prevalence of so-called cheap hand labor and the lack of proper equipment. The present war period by draining this man power into war activities offers an opportunity to make great strides toward mechanization if the proper equipment is made available. These small farmers are now clamoring for labor-saving equipment as never before.

The combination fertilizer distributor and seed planter described in this paper was designed especially for these farmers. It may not be as efficient as some of the larger machines powered by internal-combustion engines and provided with riding comforts, but it is an advancement over the present equipment and methods, and if accepted will be one step forward, a step that should help to educate the farmer in the value of labor-saving equipment. The demands which are sure to result will bring equipment that is mechanically sound, economical, efficient and easy to operate.

Fig. 2 illustrates the usual method of fertilizing and planting row crops by small farmers in North Carolina and many other southern states. As shown, this procedure consists of six separate operations performed by five machines. Five and one-half trips are required for each row. Moreover the distributor (second from left in Fig. 2) does not place the fertilizer for best results. Modifications are sometimes made in the procedure illustrated in Fig. 2 so that fewer trips are made per row but nevertheless the method and machines remain out-of-date.

A fertilizer distributor and seed planter, called the "Once-Over" (Fig. 1), which we have developed at the North Carolina Agricultural Experiment Station, combines these operations (in Fig. 2) into a single operation and places the fertilizer correctly. The use of this machine results in the efficient use of fertilizer, an increase in crop yields, a saving in labor, and a saving in power.

The experimental machine shown in Fig. 1 consists of a distributor and planter connected by a hinge with an approximately vertical pin. This permits the planter to trail in going around curves and allows for easy turning at the end of the rows. When the planter is detached by simply pulling this hinge pin, the distributor may be used as a separate machine for placing the fertilizer and bedding for transplanted crops, such as tobacco and sweet potatoes. Two handles and a clevis added to the planter make it a separate unit. It is intended that the distributor and the planter be sold as separate machines. The idea is that worn-out single distributors and single planters could be replaced as usual, with no greater cost to the farmer per unit of machine or per unit of time. A farmer finally owning the two machines and knowing that they would work together as a unit would sell himself on a combination machine with its many advantages. It would be a tactful way of getting the small farmer to ease himself out of the rut of excessive hand labor which he has followed for so long.

The machine has a lever for raising the disks out of the ground and stopping the fertilizer flow, making for easy transportation and turning at the end of the row. Fertilizer is metered out at two diagonally opposite points on a 12-in revolving plate, each directly

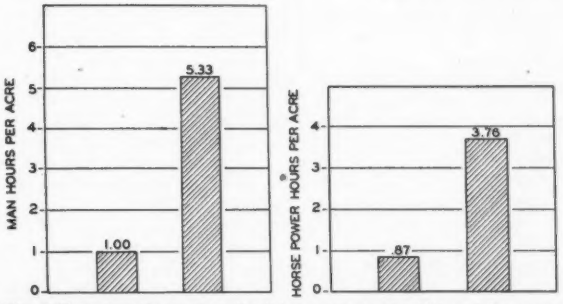


Fig. 3 These two charts show the labor requirement (left) and the power requirement (right) in planting and fertilizing cotton with the "Once-Over" distributor and planter as compared with usual practice

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AUTHOR'S ACKNOWLEDGMENT: Credit is given E. R Collins, extension agronomist of North Carolina State College, for the fertilizer placement data presented and for his collaboration in the development of the machine.

Fig. 1 The fertilizer distributor and seed planter developed by agricultural engineers at the North Carolina Agricultural Experiment Station

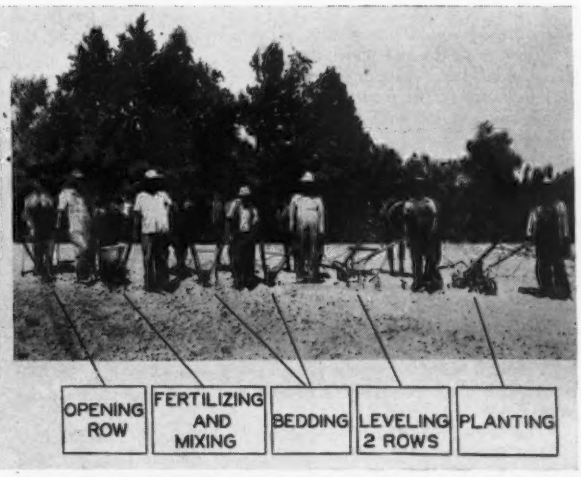

Fig. 2 This shows the usual method of fertilizing and planting row crops by small farmers in North Carolina and other southern states

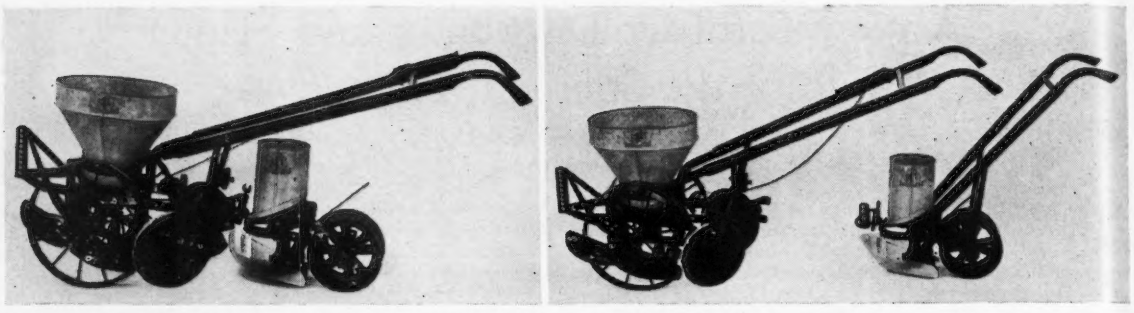

Fig. 4 (Left) The 1944 production model "Once-Over" distributor and planter • (Right) This shows the distributor-planter used as separate machines

above a disk opener. This diagonal arrangement insures that the total amount of fertilizer distributed will be approximately the same regardless of how the machine is tilted on a slope.

The disk openers are staggered one ahead of the other, and can therefore be set to move the soil inward and make part of the bed without the trouble of clogging from trash. These disks, including the fertilizer tubes, hopper, and fertilizer-dispensing device, can be revolved as a unit to give a spacing of from 5 to 12 in between the two bands of fertilizer. The disks are adjustable for depth.

An important feature of the machine is the ease with which the hopper on the distributor may be cleaned of fertilizer.

The machine has one major fault: the planter tends to slip to one side when operating on steep hillsides where the soil is loose, dry and sandy. This may cause the seed to be planted directly over one fertilizer band. Seed injury will be minimized in this case because the band contains only one-half of the total fertilizer. However, when the planter encounters a condition that will cause this sideslippage, it is best to mark off the field with open furrows (Operation No. 1, Fig. 2). The machine may then be operated on the level by keeping the uphill wheel of the distributor in this furrow.

It has been established by agricultural scientists that best results for row crops can be had by placing the fertilizer in bands at the sides of the seed row. The placement that is used depends on the machine available to the farmer. The distributor shown in Fig. 2 places the fertilizer and mixes it with the soil in the row directly under the seed. This incorrect placement of the fertilizer is a fault common to one-row, one-mule fertilizer distributors.

Best advantages with side placement are probably secured with cotton. Experimental results in North Carolina with cotton indicate that one-fifth more seed germinate when the fertilizer is placed in two bands, than when it is mixed with the soil beneath the seed. This would be a considerable saving, not only in seed, but also in labor and power where replanting is necessary. In addition to this saving, side placement will increase the yield. An average of the experimental results shows that with cotton valued at 7c per pound this method would return $10.48 per acre more than mixing the fertilizer with the soil under the seed.

The left-hand chart in Fig. 3 shows that 4.33 man-hours per acre can be saved in the planting of cotton with the "Once-Over" machine as compared with the typical procedure illustrated in Fig. 2. Three and one-half foot rows are assumed and no time is considered in turning at the end of the row. A conservative estimate is that 7,000,000 man-hours of labor could be saved annually in the Coastal Plains area in North Carolina, where approximately 2,000,000 acres of cotton, corn, peanuts, soybeans and tobacco are planted and fertilized every year by inefficient methods. Moreover, this saving would be accomplished during one of the busiest seasons of the year and at a time when success or failure of the crop may depend on getting the seed in the soil at the right time.

The right-hand chart in Fig. 3 shows that 2.89 horsepower-hours per acre can be saved in the planting of cotton by the "Once-Over" as compared with the typical procedure illustrated in Fig. 2. The power and labor measurements shown in Fig. 3 were taken at the same time.

The War Production Board allotted steel for the manufacture of the "Once-Over" distributor and planter for the 1943 planting season. Seven machines were built by a manufacturer in North Carolina and kept in the state to study, eliminate faults, and smooth out manufacturing design problems. They were sold to farmers for $55 each — a price that is considered within the income range of the small farmer. Fig. 4 shows the improved machine as manufactured for 1944.

All the important features of the experimental machine were retained in the manufactured product with the exception of the two small disk furrow openers and the adjustment for varying the spacing of the fertilizer bands. Sword openers, interchangeable with the one on the planter, were substituted for the disks. They steadied the machine but had the disadvantage of increasing the draft. The openers are set 6½ in apart but are adjustable in depth.

The seed hopper on the manufactured machine is one developed especially for the "Once-Over". It satisfies three requirements: it is simple, light in weight, and easy running, all necessary for a planter of this type. All seed, including lint and delinted cotton, are planted with the same hopper by simply interchanging the seed plates. The plates are inclined at 35 deg. A partition is used on all seed except cotton so that only a few seed come in contact with the plate near the bottom of its travel. This prevents injury to delicate skinned seed, such as peanuts. The number of holes in the plate and the speed at which it revolves are used to vary the spacing of the seed. Three sprockets (drivewheel, idler, and planter) are interchanged to give six speeds for the seed plate.

The leveling device attached to the soil opener was redesigned for the manufactured machine, to perform three functions, namely, level the bed, cover the seed, and form the soil into the shape of the rear packing wheel. This last function reduces the amount of slippage of the wheel as it does not have to move the soil inward.

The draft of the manufactured machine has not been measured, but it is greater than that required by the experimental machine, and for certain soil conditions would be too great for one-mule operation. An average of 138 lb required for the experimental machine was considered satisfactory. But it must be pointed out again that everything is being accomplished in one trip, and the farmer could afford to work the mule for only half-day periods. However, there is no shortage of mule labor in the South and it recommended that, when operating under conditions causing high draft, either two mules be used or a change of mules be made at the noon hour.

Approximately 100 lb of steel and 125 lb of gray cast iron are required to build the "Once-Over". This is less metal, particularly steel, than normally goes into the manufacture of the machines commonly used in the present practice. Considering the savings effected, steel invested in this machine represents wartime economy at its best.

Soil Erosion Control Structures

(Continued from page 108)

at culvert outlets, flume outlets, on overflow dams; in fact, at any location where the velocity entering the stilling pool is supercritical. We have just completed a bulletin describing the SAF stilling basin, and I shall not go into more detail in this paper regarding it. Copies of this bulletin are available upon request.

Fig. 12 shows the action of the SAF stilling basin. Note how the baffles in the stilling basin create turbulence that dissipates the energy in the water. The stream leaving the stilling basin is deflected upward from the bed by the end sill. The disturbance that you notice on the water surface does not extend to the stream bed and does not cause any erosion.

Farm Drainage in the Future

By P. W. Manson
MEMBER A.S.A.E.

OWING to a succession of wet seasons, with the all-out drive for food production, there is developing among the farmers of the Middle West a tremendous upsurge of interest in farm drainage. The question then arises, To what extent will this interest in farm drainage continue after the war ends?

Before looking into the crystal ball and prophesying the future of farm drainage, it is well to review briefly the history of drainage in the United States, just to refresh our minds as to the important role drainage has played in our agricultural development. After all, if farm drainage has proved itself a necessity to past generations, it most surely will be just as important to farmers in the future. The facts relative to farm drainage are amazing and have been almost obscured, or forgotten, as a result of our last drought period.

John Johnston originated tile underdrainage in the United States in 1835. As drainage men remember, he imported odd-shaped tile from Scotland to tile his farm in New York state. This first drainage project of Mr. Johnston's attracted wide publicity. Farmers from many miles around came to witness the "fool" who would poison and ruin his good land by installing drain tile. But when John Johnston increased his crop yields several hundred per cent as a result of drainage, his neighbors no longer spoke of him as the "fool", but now as the "miracle man".

During the century that has intervened since John Johnston tile-drained his farm, farm drainage has expanded to where it can now be credited for many millions of acres of our most fertile and productive land. If one will only examine the true facts relative to the benefits of good farm drainage, he cannot help but appreciate drainage as one of the important steppingstones in our agricultural advancement.

Fig. 1 shows the magnitude and the general location of all drainage enterprises in the United States and is based on the 16th Census Report of the United States (1940). These drainage enterprises total about 87 million acres. To clarify the meaning of a drainage enterprise, the following definition from the 1940 drainage census is quoted: "A drainage enterprise is the area organized in one drainage district, or assessed for the same public drain, or in corporate or in private ownership drained by works operated as one undertaking. Privately owned enterprises draining less than 500 acres each were omitted from the census, but all enterprises established under state drainage laws were included."

The 87 million acres in drainage enterprises is quite sizable and may make some people wonder whether or not such an immense area has really been devoted to agriculture. The best available data show that almost 80 per cent of this 87 million acres is classified as improved land. It is also important to note that there are millions of drained acres not included in any enterprise. A conservative estimate might be that there are about 80 million acres of improved, fertile land resulting from drainage. A large percentage of the unimproved land is located in northern Minnesota and in some of the Gulf states. There is very little land in the corn belt area that is drained and not used for agriculture. In this discussion, we are mostly concerned with the 80 million or more acres of improved agricultural land that has been made more productive and profitable by drainage improvements.

Fig. 1 Map showing location of land in drainage enterprises in the United States according to the 1940 Census

Table 1 is a composite of data from Part II of the National Resources Board Report of 1934 and the 16th Census of the United States relative to the drainage of agricultural lands (1940). Reference to Table 1, Fig. 2, and Fig. 3 shows a close correlation between the location of our best farm lands and drainage installations. In other words, only a small percentage of all farm drainage has not resulted in profitable returns. Few, if any, drainage bonds have been defaulted where the enterprise area was cultivated prior to drainage.

Dr. Curtis F. Marbut, one of the contributors to the National Resources Board Report, then of the Bureau of Chemistry and Soils (USDA), classified the entire land surface of the United States into five grades based on productivity. While Dr. Marbut admits that this rating is only of a tentative character, it is considered the best land index yet published. Dr. Marbut's classification takes into consideration the principal physical conditions influencing productivity, such as soil type, topography, rainfall and temperature.

Grade 1 land is described as excellent land for staple crops climatically adapted to the region in which they are grown; grade 2 land as good; grade 3 land as fair; grade 4 land as poor; and grade 5 land as essentially incapable of tillage. The physical classification of the estimated acreages of land in the United States, based on its natural productivity, is shown in Table 2.

Drained lands were graded according to their productivity under their present drained condition. That is, land of poor natural drainage may be classified as grade 4 land before drainage and as grade 1 land after drainage. Irrigated lands were graded according to their original non-irrigated condition.

Table 1 gives the acres and percentages of grade 1 land, grade 1 and 2 land combined, and drainage enterprises for each state. The states are grouped into five sections, and the order of the states in each section is based on the number of grade 1 acres in the state. In examining Table 1, it should be kept in mind that in the corn belt area nearly all of the drained land is classified as grade 1 land.

Table 1 shows that about 90 per cent (91 million acres) of the grade 1 land, and about 67 per cent (208 million acres) of the grade 1 and grade 2 land combined, are located in the north central states. This is very significant when it is considered that only 5.3 per cent of all our land is classified as grade 1, and only 11.1 per cent is classified as grade 2 land. In this north central area we have located 65 per cent (56 million acres) of the total acreage listed in total drainage enterprises, which constitutes an area equal to 56 per cent of the grade 1 land of the United States or 18 per cent of the total grade 1 and grade 2 land combined. By including the data of the south central states along with the data of the north central states we find that about 99 per cent of the grade 1 land, and about 89 per cent of the grade 1 and 2 land, is located in this area. That is, the most productive land in the United States is situated in the Mississippi River basin where 84 per cent of the drainage enterprises are located.

Fig. 2 is a map of the agricultural regions of the United States published in the 1941 issue of "Land Classification in the United States". Fig. 3, with the exception of the heavy line locating the outer edge of the corn belt shown in Fig. 2, is from Part II of the 1934 National Resources Board Report. In Fig. 3,

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the outer rim of the corn belt area is superimposed over the drainage area to show the close correlation that exists between drainage and our most productive land, known as the corn belt area.

The shaded area of Fig. 3 indicates the percentage of farms in each county of the United States provided with artificial drainage. This data is based on the 1930 drainage census and would vary but little from the present data if it were available. It is of interest to note that the average corn yield per acre for the 10-year period, 1930-39, for each state of the corn belt is as follows: Ohio, 38.8 bu; Iowa, 37.2 bu; Indiana, 36.2 bu; Illinois, 36.2 bu; Minnesota, 30.6 bu; Missouri, 20.6 bu; Nebraska, 14.6 bu; Kansas, 12.2 bu, and South Dakota, 11.2 bu. The low yields are from the western states where the precipitation is lowest and drainage is not generally so necessary. Soil fertility, precipitation, temperature, and natural and artificial drainage have made this section the greatest food-producing area of the world.

In the future, any soil-saving program must include drainage. The flat bottomlands when properly drained offer no erosion problem and still maintain their high fertility. For instance, Iowa with its abundance of fertile land is now working out a soil-saving program with drainage as a major part. Between 50 and 60 per cent of Iowa's cropland has moderate erosion where 25 to 50 per cent of the topsoil has been removed, to severe erosion where all the topsoil has been removed. Crop yields in Iowa showed a definite increase with the advent of drainage, but now with erosion so evident they have shown a decline in yield. This depletion of soil fertility by overcropping on the slopes is common to most states. I think the future will see intensified farming on the relatively flat land, much of which has been made productive through drainage, and our modern soil-saving practices used on the sloping land. This will be a long-time program requiring much drainage foresight.

TABLE 1. PHYSICAL CLASSIFICATION OF THE ESTIMATED ACREAGE OF LAND IN THE UNITED STATES IN GRADE 1, IN GRADE 1 AND 2 COMBINED, AND THE ACRES OF LAND LISTED IN DRAINAGE ENTERPRISES

State	Grade 1 land		Grade 1 and 2 land combined		Drainage enterprises	
	Acres	Per cent	Acres	Per cent	Acres	Per cent
North Central States						
Iowa	25,983,110	25.7	32,889,268	10.5	6,164,344	7.1
Illinois	14,777,030	14.6	21,624,175	6.9	5,091,364	5.9
Minnesota	12,022,243	11.9	24,161,058	7.7	10,990,409	12.6
Missouri	8,674,763	8.6	22,507,813	7.2	3,087,063	3.5
Nebraska	8,120,907	8 0	17,810,975	5.7	916,181	1.1
Indiana	5,262,498	5.2	11,700,875	3.8	10,121,952	11.6
Ohio	4,214,074	4.2	10,448,279	3.3	7,729,267	8.9
Kansas	3,765,287	3.7	18,937,523	6.1	258,113	0.3
S. Dakota	3,052,320	3.0	11,827,685	3.8	676,472	0.8
Wisconsin	2,820,276	2.8	17,350,257	5.6	761,203	0.9
Michigan	2,251,155	2.2	11,212,353	3.6	8,978,386	10.3
N. Dakota	0	0.0	7,365,682	2.4	1,376,041	1.6
Total	90,943,663	89.9	207,835,943	66.6	56,150,795	64.6
South Central States						
Oklahoma	1,700,604	1.7	14,495,764	4.6	197,646	0.2
Texas	1,591,147	1.6	21,051,655	6.7	4,218,850	4.9
Arkansas	1,452,484	1.4	9,404,889	3.0	4,592,738	5.3
Louisiana	1,289,430	1.3	4,262,172	1.4	4,219,624	4.9
Tennessee	902,258	0.9	5,672,105	1.8	601,592	0 7
Kentucky	863,916	0.9	5,884,340	1.9	465,270	0.5
Mississippi	844,230	0.8	6,180,689	2.0	2,890,618	3.3
Alabama (included with Virginia)	0	0.0	3,002,499	1.0	0	0.0
Total	8,644,069	8.6	69,954,113	22.4	17,186,338	19.8
South Atlantic States						
W. Virginia	388,551	0.4	1,738,778	0.6	0	0.0
Maryland	143,732	0.1	2,018,259	0.6	183,337	0.2
Florida	71,161	0.1	1,004,348	0.3	5,699,022	6.6
Delaware	0	0.0	222,080	0.1	395,014	0.5
Virginia	0	0.0	3,653,134	1.2	43,759	0.1
N. Carolina	0	0.0	1,166,506	0.4	825,576	0.9
S. Carolina	0	0.0	296,359	0.1	204,366	0 2
Georgia	0	0.0	1,851,537	0.6	84,374	0.1
Total	603,444	0.6	11,951,001	3.9	7,435,448	8.3
Western States						
Oregon	342,536	0.3	2,401,961	0.8	348,825	0.4
Washington	83,520	0.1	625,658	0.2	405,709	0.5
California	46,976	0.1	525,273	0.2	2,667,194	3 1
Montana	0	0.0	0	0.0	372,661	0 4
Idaho	0	0.0	87,288	0.0+	659,136	0.8
Wyoming	0	0.0	0	0.0	312,662	0.4
Colorado	0	0.0	285,670	0.1	468,322	0.5
New Mexico	0	0.0	0	0.0	305,885	0.4
Arizona	0	0.0	0	0.0	298,633	0.3
Utah	0	0.0	0	0.0	202,058	0.2
Nevada	0	0.0	0	0.0	153,373	0.2
Total	473,032	0.5	3,925,850	1.3	6,194,458	7.2
North Atlantic States						
Pennsylvania	177,151	0.2	6,445,255	2.1	0	0.0
New York	94,037	0.1	6,957,971	2.2	0	0 0
Connecticut	48,452	0.1	387,072	0.1	0	0.0
Vermont	33,217	0.0+	933,805	0.3	0	0.0
Massachusetts	11,906	0.0+	771,713	0.2	0	0.0
New Jersey	6,272	0.0+	949,540	0.3	0	0.0
New Hampshire	2,330	0.0+	239,542	0.1	0	0.0
Rhode Island	0	0.0	5,463	0.0+	0	0.0
Maine	0	0 0	1,615,033	0.5	0	0.0
Total	373,365	0.5	18,305,394	5.8	0	0.0
Grand total	101,037,573	100.0	311,972,301	100.0	86,967,039	100.0

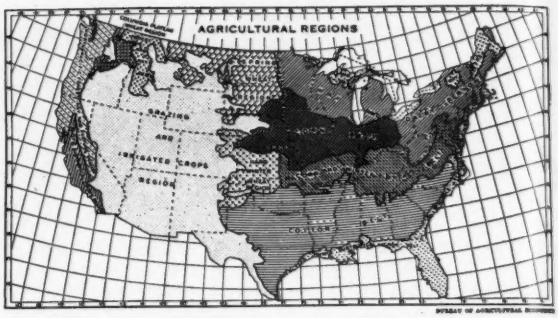


Fig. 2 Map of the agricultural regions of the United States as published in the 1941 issue of "Land Classification in the United States" by the Bureau of Agricultural Economics (USDA)

TABLE 2. ESTIMATED ACREAGE OF LAND IN THE UNITED STATES BASED ON ITS NATURAL PRODUCTIVITY

Grade 1 — 101,038,000 acres (5.3 per cent)
Grade 2 — 210,935,000 acres (11.1 per cent)
Grade 3 — 345,872,000 acres (18.1 per cent)
Grade 4 — 362,559,000 acres (19.1 per cent)
Grade 5 — 881,735,000 acres (46.4 per cent)

From all indications much drainage will continue in the corn belt area. The reclaimed wet lands of the Mississippi River basin are so productive when drained that farmers in this section cannot afford to neglect drainage. It is roughly estimated that upwards of 10 per cent of the farm land in the northern half of Iowa and the southern half of Minnesota are not adequately drained. This estimate includes repairs of old systems as well as installations of new systems. The past few wet years have exposed the faults of many drainage systems. The future will see many tile lines replaced because of poor original design, faulty construction, or improper maintenance.

The past few wet years have also exposed many outlet ditches that are not functioning properly. The farmer must be made to realize the importance of good maintenance. Every effort should be made to improve land of high productivity and not attempt to drain lands where the expense will be excessively high. Much of this outlet work will require new assessments or the organization of new districts. It is hoped that the drainage laws in some states will be amended to facilitate outlet maintenance.

Even in areas quite remote from the corn belt and where the annual precipitation is as low as 20 to 25 in, farmers are now demanding drainage. This is true in the Red River Valley of northwestern Minnesota where much surface drainage is now being done, later to be followed by more complete systems after the drainage districts are set up. Heavy precipitation during the growing season gives this district its big problem.

During the past 25 years, sufficient research has been conducted so that today we can almost design a drainage system based on facts. Studies of relative runoff, spacing and depth of laterals, soil permeability, crop injury, quality of tile, capacities, and maintenance have helped to gain the goodwill and confidence of the public.

Many farms have had to remain too wet for optimum crop production because they lacked a natural outlet for their interior drainage. This problem has now been solved by the sump or pumping outlet. With farm electrification covering most rural areas, sump outlets may be quite common in the future in areas where no natural outlets are available or where such outlets would be too expensive.

Even with all these advancements in drainage, the engineer or contractor is still confronted by one serious problem. Good tilers, at least in this section of the country, are almost a gem of the past. If this labor deficiency continues, there is but one solution, and that is that some low-cost, efficient mechanical-trenching equipment must be developed.

The present abundance of machinery — and more can be expected — on the modern farm will result in more drainage.

No farmer in the future will permit low, wet spots to clutter up his farm as places for his tractor, or other equipment, to bog

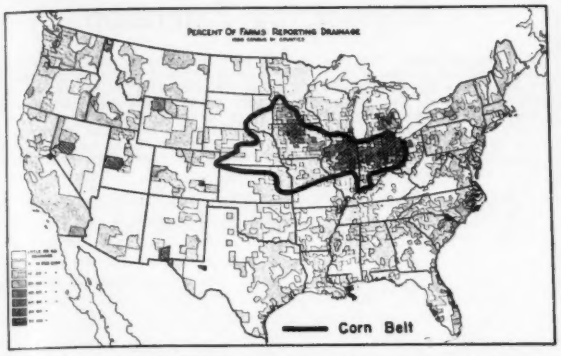


Fig. 3 Map of the United States showing the percentage of farms in each county provided with artificial drainage and the location of the corn belt area. Note the close correlation that exists between drainage and the most productive land

down during the busy season. This has been a common 1944 complaint from Minnesota farmers.

While none too familiar with the West, I do appreciate that no irrigation system is complete without some parallel drainage systems. The purpose of tile drains in the irrigated regions are twofold: to remove the gravitation water before plants are injured, and to prevent the excessive accumulation of salts in the root zone. Since over 21 million acres of land was irrigated in 1939, and no doubt millions more will be irrigated in the future, much drainage has been done and much more can be expected in the West.

Prior to World War II much effort was being expended to encourage the withdrawal of poor lands from cultivation. As a result, the National Resources Board in 1934 estimated that we would need for the present about 25 million additional acres of good farm land to offset the area of poor land that should be removed from farming. The Board also estimated that by 1960 we would need, all total, an additional 47 million acres of good farm land. These estimates were made assuming peacetime conditions and average present day productivity.

This additional cropland must come from the following three sources: cutover land, irrigable land, or drainable land. Drainable land offers the most available and economical reserve of fertile land to draw upon. It is estimated that at least 100 million acres of land in the United States is unfit for cultivated crops or improved pasture because of inadequate drainage. Probably one-third of these lands, whose fertility and ultimate productivity is high, could be drained for amounts not to exceed 30 dollars per acre. The overall drainage cost for all enterprises listed up to 1940 has averaged about 10 dollars per acre.

Now we are entering another period quite comparable to the 1920's, high prices and wet years. It is well to recognize that wartime conditions are likely to make drainage at this time more costly and difficult. Moreover, farmers should be wary of any investment, drainage or otherwise, if it means debts that cannot be paid off in large part while agricultural prices remain at wartime levels.

The time is ripe that some of us soil and water engineers take up the pen, or the tongue, and give the public some of the truths relative to the benefits derived from proper drainage.

First, as agricultural engineers, let us not promote any drainage enterprises that have not been thoroughly investigated and proven sound. That is, before recommending a complete drainage system let us make sure that the land is of suitable productivity to warrant the expense. Then lay the facts before the farmer explaining in detail what increase in yields may be expected after drainage, that crop prices will not remain high for an indefinite period after the war, and just what a complete drainage system will cost per benefited acre. Then let him decide whether or not he should make the investment.

Considered as a means of enhancing the productiveness and operating efficiency of existing farms, tile drainage properly installed is an investment that pays big dividends. Studies by the division of agricultural engineering of the Minnesota Agricultural Experiment Station show that the extra returns secured each year from drained land range from 8 to 50 per cent of the total cost of tile installation, with 15 to 20 per cent as an average. This represente a large return on an investment which, with proper maintenance, may last for generations.

Contrary to popular belief, tile drainage of mineral soils has no undesirable results in dry seasons. A mineral soil *cannot* be overdrained. Tile drainage removes only excess water detrimental to plant growth and cannot disturb the capillary water which plants require. If a dry season follows a wet spring, proper drainage will make for a healthier, deeper root development, enabling plants to resist drought conditions much better than plants with shallow roots produced on undrained fields. The other benefits of tile drainage are too well known to enumerate here.

I firmly believe that there will always be a big future for farm drainage. Good farm drainage has proven a sound investment in the past and will continue to do so in the future, because good farm drainage is essential to successful agriculture.

Using Dehydrator as a Heater

By Lawrence C. Porter
FELLOW A.S.A.E.

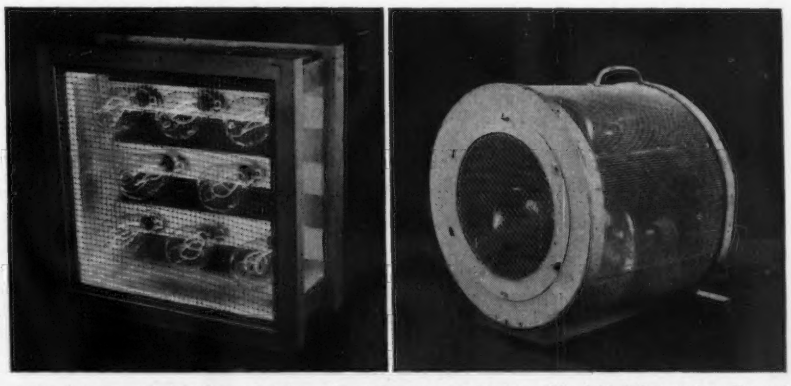
NOW that plenty of canning equipment is available, many home-built dehydrators have been set aside to take up space and collect dust. These units can be used as clothes driers (AGRICULTURAL ENGINEERING, vol. 24, no. 12, p. 411, December 1943), or the heating element may be removed and converted to a room heater or food warmer, and the cabinet use for storage purposes.

To do this the heating unit should be surrounded (sides and bottom) with ordinary wire screen. The top should be hinged to enable renewal of burned-out lamp bulbs or regulation of the heat by unscrewing one or more bulbs. Five-sixteenths-inch hardware cloth should be used on the cover to give sufficient strength to support whatever is placed on top for warming purposes. Four rubber buttons may be placed on the bottom and four on one side to prevent scratching polished floors or table tops.

When the unit is used as a room heater, it is turned up on edge to save space (as shown in the accompanying picture). If 250-w reflector-bulb heat or drying lamps were used in the dehydrator, a very compact little room heater can be made by grouping three of them, as shown at the right in the picture. If a small fan is available, it can be placed between the sockets to make a circulating radiant heater. Such a fan is used in the heater shown in the picture.

If gas-filled tungsten-filament lamps are used, care should be taken to prevent liquids dripping onto the bulbs, as that is likely to crack them. If carbon-filament lamps are used, as shown in the picture, water dripping on them will not crack the bulbs.

LAWRENCE C. PORTER is illuminating engineer, Nela Park Engineering Division, General Electric Co.



(Left) A homemade dehydrator heating unit used as a room heater, with eight 120-w carbon-filament lamps • (Right) A circulating type of room heater

Water under pressure increases farm Profits

BOOSTS EGG PRODUCTION
Plenty of water increases egg production. If water is warmed in winter, still greater increases are obtained.
INCREASES MILK PRODUCTION
Records show milk production increases 10 to 24% when cows have enough clean, fresh water.
GARDENS YIELD MORE
Get more produce from gardens by watering regularly—and get better quality, too. It's easy with water under pressure.
LIVING WILL BE BETTER
You can enjoy all of the conveniences of modern baths and kitchens with water always on tap where you want it.

Labor costs go down. Farm production goes up. That's why water under pressure increases farm profits. In addition to pumping water there are many other ways in which electricity can help you increase production and cut costs. It will pay you to know about them all in planning improvements for your farm. Your local power supplier or dealer can tell you what is available. When you buy, remember that Westinghouse quality assures dependable service.

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Recommendations for Agricultural Engineering Extension

EDITOR'S NOTE: The recommendations set forth in the following report compiled by Ralph C. Hay, chairman of the A.S.A.E. Committee on Extension, were submitted to the Extension Service, U. S. Department of Agriculture, for transmittal in turn to extension agricultural engineers in all states for guidance in planning their work programs during 1945. Members of the Committee on Extension served as chairmen of the three subcommittees referred to in the report, as follows: L. G. Samsel, power and machinery; H. J. Gallagher, rural electrification, and E. L. Hansen, farm structures.

AT A conference called by the Committee on Extension of the American Society of Agricultural Engineers in Chicago on December 15, 1944, three subcommittee representing industrial interests in power and machinery, rural electrification and farm structures prepared the recommendations for agricultural engineering extension in 1945 set forth in this report.

The subcommittees were asked to answer these three questions in making their report, as follows:

1 What are the most important problems needing attention at this time?

2 What specific plans of action are recommended?

3 What methods and procedures are necessary to coordinate these plans, programs, publicity, etc?

Although some of the proposals represent repetition of programs now under way, there is serious thinking back of each of these reports intended to guide and encourage extension engineers in these trying times.

RECOMMENDATIONS OF THE POWER AND MACHINERY SUBCOMMITTEE

Problem 1. Farm Machinery Emergency Maintenance. Because of continuing shortages of man power and some special materials, production of farm equipment is about 1¼ years behind in supplying normal farm needs. Machine production for 1945, or even 1946 or later, will probably not be sufficient to fill all the needs for new equipment. Many overage machine will continue in service for several years. A continued, intensive campaign on farm machinery maintenance therefore is believed desirable.

The following *plan of action* is recommended:

1 Urge early checkup of all machines for service and *necessary* replacement parts.

2 Advise owners to order early only parts needed and avoid repeating orders. Extend the life of worn parts as long as possible. Rebuild or repair broken parts whenever practicable.

3 Encourage owners to arrange with dealer for an early checkup of machines likely to need shop service. Dealers are short of shop help and need full cooperation so that they can schedule shop work and give the best service possible to owners.

4 Recommend proper protection of equipment in storage against rust, corrosion and distortion.

5 Stress proper care, operation and adjustment of specific machines.

6 Point out the need for checking owner facilities and tools for proper maintenance and operation throughout the year—specifically tools, farm shop, equipment for handling fuels and lubricants, etc.

Problem 2. Efficient Use of Machines in Production and Conservation of Food and Fiber Crops. The food production program to meet war needs promises to continue into 1945. There is little if any relief in sight from the shortage of farm labor, seeds and fertilizers. Continued efforts to conserve food and produce more efficiently are therefore important.

The following *plan of action* is recommended:

1 Neighborhood exchange and custom use of tractors and machines.

2 Faster and more economical use of machinery by balancing the tools with the power available, being careful not to overload the tractor.

3 Faster and cheaper methods of seeding and planting. Examples: (a) Utilization of individual planter for wider variety of row crops by use of additional plates, special attachments and adjustments; (b) use of grain drill for row crops when practicable; (c) accurate setting of seeders and planters to get better stands and to avoid wasting seed.

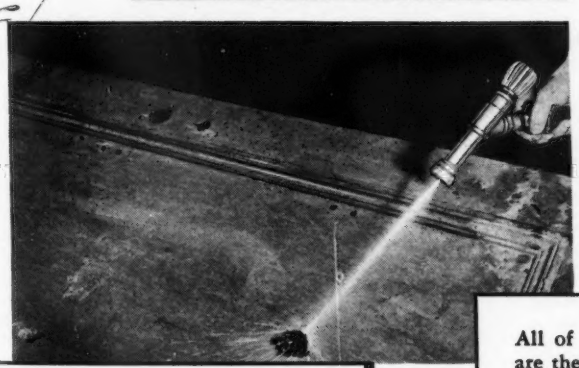
4 More efficient cultivation of row crops. Examples: (a) Use of rotary hoe and spiketooth harrow where practicable to replace shovel cultivation; (b) shallow cultivation to avoid root injury and conserve fuel.

5 More efficient harvesting of crops. Examples: (a) Proper combine, binder and thresher adjustments; (b) add to seed supply of strategic crops by harvesting those seed crops often left in the field in ordinary times; (c) ensiling, especially waste crops; (d) efficient haying methods to preserve quality and vitamins and reduce labor and storage requirements; (e) proper operation of machine corn pickers; (f) leakproofing of wagons and trucks; (g) weather and rodentproof storage facilities.

(Continued)

This "Water Test" Shows Which Lubricant Can Weather Storms

CUP GREASE WASHES AWAY. When the hose is turned on a small amount of cup grease smeared on a steel surface, the grease washes away leaving the surface practically unprotected against rust and rapid wear.



MARFAK LUBRICANT STICKS. When the same stream of water is turned on a small amount of Marfak, the water spatters in all directions, but Marfak stays put, indicating its high resistance to water wash.

ONLY one farmer in three uses the right kind of lubricant for his farm machinery and applies it at the recommended frequencies, according to a poll of 41 Agricultural Engineers in the leading Agricultural States.

Several Agricultural Engineers stated that the most common practice on the part of farmers was to use ordinary cup grease as an "all-purpose" lubricant.

The ideal lubricant for grease cup or pressure gun application is one that will stick to the bearing surfaces once it has been forced onto them — a lubricant that resists water wash, oxidation and stays on despite the jolts and jars of field operation or the heat of summer temperature.

Marfak lubricant meets these specifications to the highest degree. The simple hose test illustrated at the left shows how much greater resistance to water wash there is in Marfak than in ordinary cup grease.

THE TEXAS COMPANY

All of Texaco's Products for the farm are the result of the most extensive research and study and are specifically designed for the job for which they are recommended. That's why they stand up in field operation or in tests as indicated by pictures above.

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Screeding layer of Zonolite Insulating Concrete over old floor of pen in hog house.

Row of farrowing pens with 3-inch Zonolite Insulating Concrete installed over old floor.

Talk ZONOLITE INSULATION

and you talk increased egg, milk and pork production!

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DAIRY BARNS

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You know how warm, dry floors in hog houses reduce farrowing losses—how warm, dry poultry houses increase egg production—and how warm, dry dairy barns increase milk and butter fat production during winter months. *Talk Zonolite* and you talk increased profits for your farmers.

Zonolite is a mineral insulation. It is rot-proof, fireproof, rodent proof, termite proof, odorless, a non-conductor of electricity and chemically inert. It comes in three forms.

Zonolite Granular Fill is poured from the bag like popcorn, and is used to fill sidewalls and ceilings of poultry houses, hog houses and dairy barns as well as homes.

Zonolite Concrete Aggregate is mixed with cement and water to make warm, dry floors and walls in all types of farm buildings housing livestock and poultry.

Zonolite Plaster Aggregate is used instead of sand to make a plaster that insulates against cold, heat and sound. It resists cracking and will not flake when nails are driven in it.

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6 Safe operation of farm equipment, calling attention to the importance of installing and using the guards and safety shields furnished by manufacturers and also encouraging safe habits of operation.

7 Better handling of barnyard manure.

8 Special attention to plow adjustments for proper incorporation of organic matter and more effective control of corn borers and other insects.

Problem 3. Better Machine Application to Soil and Water Conservation. Tested soil and water conservation practices not only promise the preservation of our most valuable national asset, but also indicate immediate results in increased crop yields and reduced power costs. Since the practices often involve uncommon uses of farm machines, it is desirable to give soil and water conservation some consideration.

The following *plan of action* is recommended:

1 Pasture management. Examples: (a) Cultivating, renovating, reseeding and fertilizing; (b) contour furrowing.

2 Contour farming. Examples: (a) Tillage and seeding methods; (b) minimum permissible curves for satisfactory operation of equipment.

3 Establishing grassed waterways. Examples: (a) Use of manure spreader to distribute root stocks; (b) use of combination drill for quick start and good stand.

4 Terracing. Examples: (a) Tested procedure for construction with present tillage equipment; (b) procedure for terrace maintenance.

METHODS AND PROCEDURE SUGGESTED FOR CARRYING OUT PLANS OF ACTION RECOMMENDED BY THE POWER AND MACHINERY SUBCOMMITTEE

Efficient use and maintenance of existing farm machinery for full production of food and fiber crops will require complete utilization of all available service and maintenance facilities as well as proper operation and application of the machinery.

To utilize fully the existing service facilities of the nation's farm machinery dealers, it is important that farmers not only realize the necessity for proper maintenance on the farm, but also understand the urgent need for planned and early seasonal use of local dealer parts and shop facilities.

While educational agencies have assisted much during this emergency in the promotion of these objectives, there still appears to be opportunity for improvement in the full use of these established service facilities by continuing educational programs conducted by the respective state and county extension agencies.

Following are suggestions which this subcommittee believes may well be considered in the continuation of these educational activities:

1 Make full use of publicity agencies in carrying on any of the suggested plans of action previously outlined.

(a) Radio: (1) prepare scripts or recordings suitable for use on local stations; (2) make early contact with stations for free time available or leads to possible paid sponsors.

(b) News releases for state, county and local papers: (1) Ready-prepared releases in stereo or mat form, sent as far in advance of their use as possible, are more certain of being used; (2) urge contact with advertisers as possible sponsors.

(c) Circulars: (1) Simple mailing pieces covering early parts orders, shop service, service schools, etc., would be gladly sent out by many equipment dealers; (2) a series of simple circulars, each timed with seasonal farm activities, is suggested.

(d) Posters: (1) Simply worded reminder posters can be effectively displayed in stores and all community gathering places.

(e) Farmer meetings: (1) Cooperation with equipment dealers is invited; (2) time meetings with appearance of news releases, posters and radio broadcasts.

2 Contact equipment manufacturers and branches in the state, keeping them informed of the educational program in the state.

(a) Request available educational materials: (1) Instruction manuals; (2) educational booklets, films, posters, etc.

(b) Offer or request possible speaker assistance at farmer meetings.

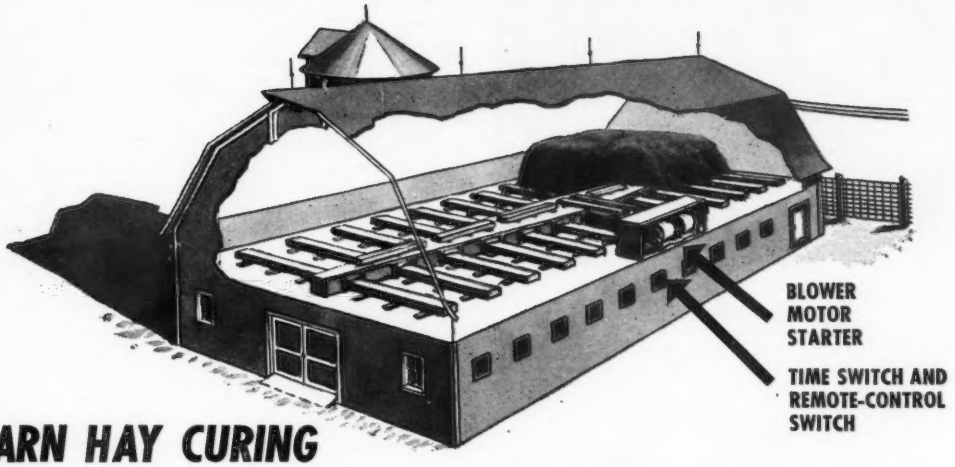
(c) Obtain information on availability of machines and parts.

The foregoing suggestions are of necessity general in nature. Each individual extension worker will be acquainted with the advised farm production practices and needs of his state and will be able to make local application of any usable ideas included.

RECOMMENDATIONS OF RURAL ELECTRIC SUBCOMMITTEE

Most farm families are convinced they must have electric service. More than 2,600,000 farms are connected to power lines today. Farms will be electrified in the postwar period at a more rapid rate than ever before. Electricity is new and strange to farmers, so from the beginning they need help in understanding it and planning for its use, if they are to get the fullest advantage at the lowest cost. Before the war the informational and educational work to guide

NOW... Hay worth $5 to $10 more a ton!



BARN HAY CURING

also means less danger of loss from fire and bad weather

HUNDREDS of farmers are curing hay in the mow. They reduce the loss of cuttings during bad weather. Their hay is worth $5 to $10 more per ton. They store as much as 50 per cent more hay in the mow.

When you have a barn hay dryer you can put hay into the barn before much of its original food value is lost. The hay has better color and contains more leaves and tender stems that are usually lost during handling. With this highly nutritious hay you need to buy less protein feed. The increased food value shows up in the milk pail or on the animal.

Dryers are simple to install and operate. Hay is cut in the normal way, but put into the barn much sooner. The first cutting is spread over ducts on the mow floor to a depth of eight to twelve feet, and the blower turned on to finish curing. When the top layer is dry, curing is completed. Additional cuttings, spread on top of the cured hay in six- to eight-foot depths, are cured in the same manner. Chopped hay is cured in thinner layers. Baled hay can also be cured—ducts are not required.

A few equipments available

WPB has approved a limited number of installations for 1945, and General Electric is now building motors and a special type of control for hay drying. You need a priority and *you must act quickly* if you want to buy equipment this year.

Your G-E dealer will help you determine the equipment you need and plan your installation. Ask him for our new bulletin, GEA-4401, which will give you more information on drying and electric equipment. If he doesn't have the bulletin, write Farm Industry Division, General Electric Co., Schenectady 5, N.Y.

BUY WAR BONDS *as your stake in America's future*

GENERAL ELECTRIC

THERE'S MORE TO A SHACKLE THAN SIZE AND TYPE

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ACCO SHACKLES are forged from fine grain steel which has superior forging qualities—a steel which can be depended upon for uniform product with uniform tensile strength.

All **ACCO SHACKLES** are forged in solid dies. Most sizes are drop-forged already bent. This also insures greater uniformity.

Every shackle is rigidly inspected. Special lights enable inspectors to see even the smallest defect. It is almost impossible for a faulty shackle to get by **ACCO** inspectors.

In the case of shackles with a screw pin, the pin is drop-forged and accurately threaded for continued easy operation.

ACCO SHACKLES, in short, are made to do their job—better.

ACCO SHACKLES are made in both chain and anchor type—of material from ¼ inch to 2 inches—with round pin or screw pin—finished self-colored, blacked or galvanized—shipped in kegs or barrels, depending on quantity.

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farm families in judicious use of electricity, wiring, etc., has not been able to keep pace with the connection of farms.

Postwar extension work, unless drastically enlarged, will fall far behind the needs of farmers getting electrical connections or already served. There is such a difference between the advantages taken of the availability of electricity on the farm by a farm family that has a true understanding and which does sound planning as against one that is devoid of these benefits, that an enlarged extension program carried on to supplement the efforts of industry along this line represents an important extension responsibility.

I. What are most important problems needing attention at this time?

To establish in the minds of farm people the conviction and understanding that farm families can put electricity—a major power source which is becoming generally available on the farm—to work on many more farm production jobs and in the farm home to improve farming efficiency, profit, and pleasure of living on the farm; and that the more general, judicious use of electricity in the business of farming, as well as in the farm home, is vital to maintaining agriculture's economic and social position in America. (This statement was unanimously adopted by the subcommittee as the most important problem in rural electrification.)

II. Specific plans of action recommended:

1 Include speakers on electrical subjects on college farm and home week programs and other farm meetings.
2 Sponsor state rural electrification annual conferences of about two or three-day duration for interested workers.
3 Set up in-service courses for agricultural and home economics workers on applications of electricity to agriculture and the home that may carry college credit.
4 Encourage more general use and distribution of available informational bulletins, films, etc., from public and private agencies.
5 Add electrification courses to the agriculture curriculum of colleges and vocational agricultural schools.

(NOTE: In setting up any of these activities, industry and other groups associated with the offering of these recommendations will gladly cooperate and help in planning and carrying on the work.)

RECOMMENDATIONS OF THE FARM STRUCTURES SUBCOMMITTEE

Representatives of the farm structures industry, recognizing that farm structures are essential tools of production, welcome this opportunity to cooperate with federal and state extension services in offering the following suggestions that may be of aid to these agencies in setting up the 1945 extension program:

I. What are the most important problems in this field that need attention at this time?

Since we cannot foresee any substantial improvement in the critical building material and man power shortage situation in 1945, programs should be built around the theme "Repair now — rebuild after the war."

Such a program would involve three essential steps on the part of the farmer:

1 Project a plan to determine what buildings will be needed to operate his farm efficiently after the war and to determine their proper arrangement in the farmstead.

2 Survey existing buildings to determine which fit into this plan from the standpoint of location, adequacy and safety.

3 Based on points 1 and 2, determine the extent of repairs or remodeling that should be done to eliminate useless waste of food and labor and maintain quality of product housed therein for the present emergency. Also, he should determine the extent of remodeling that should be done if building is to be fitted into the long-time plan.

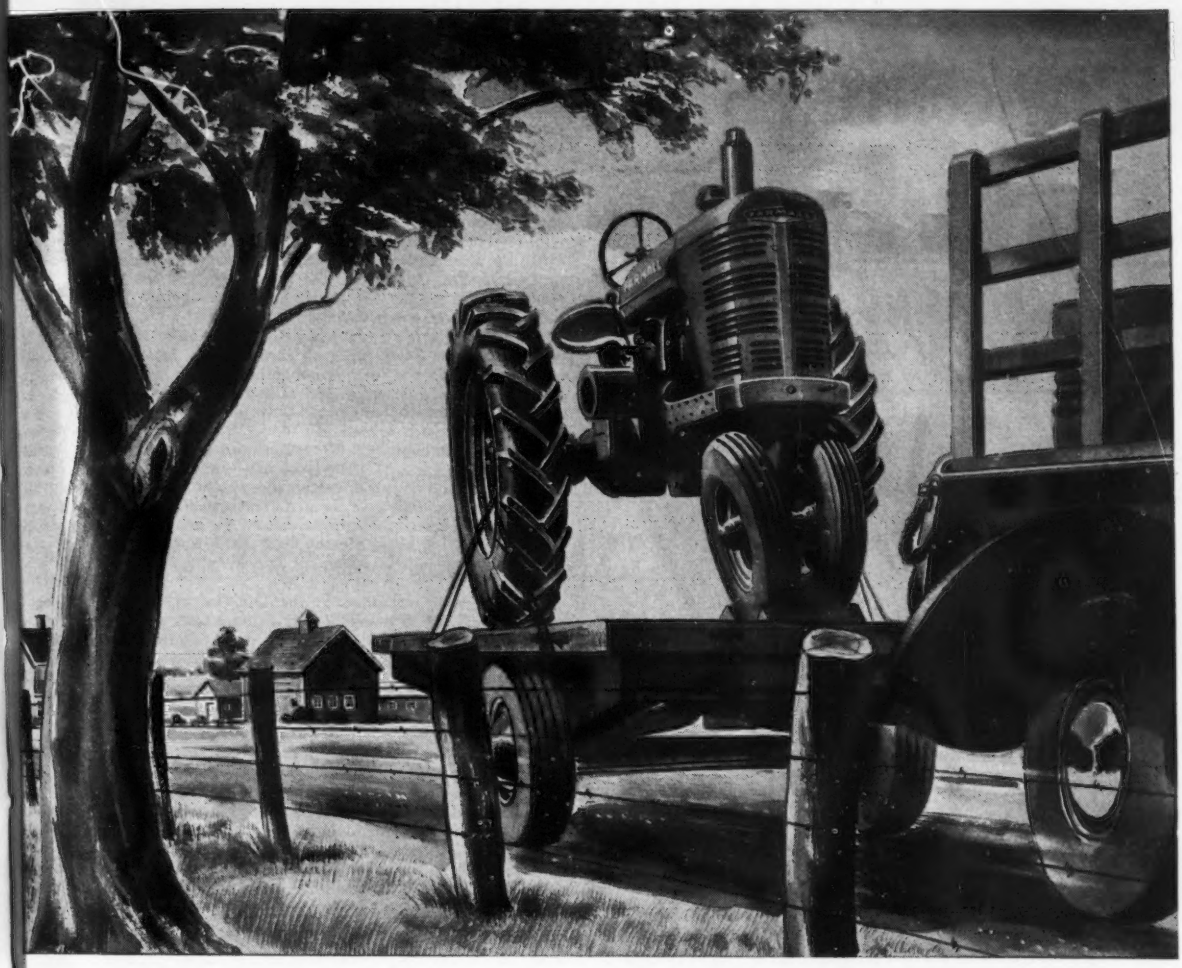
II. What specific plan of action is recommended to assist the farmers in carrying out this program?

It is recommended that the building industry and extension services cooperate in an effort to educate extension workers in all fields, distributors of building materials, rural builders, community leaders and farmers, to the relative value of farm structures in farm production. Specific examples may be cited as follows:

1 This year in the Red River Valley, there has been a large production of corn. Power, labor, seed, fertilizer, etc., have been spent in producing this crop. Reports now indicate that the crop is piled on the ground in many areas. If it is allowed to remain there into the spring months, a large part of the value of this corn will be lost, thus wasting a large share of the power, labor, etc., that went into its production.

Thus our crop and soil specialists have been able to increase yields of grain, and our machinery manufacturers have increased the efficiency of harvesting, but what is the good of raising 500 bushels more of grain if it is placed in a building that is not weathertight or ratproof.

2 When an increase was asked for in the production of poultry and eggs, it was estimated that at least a 30 per cent increase could



WHAT FACTORS HAVE ACCELERATED THE TREND TO HIGH COMPRESSION?

The swing to high compression engines for tractors has been accelerated by the war. The need for greater food production and the shortage of farm help called for increased *tractor power*. Thousands of farmers turned to high compression to get this needed power.

But this trend to high compression is not new. It has been going on for ten years, ever since 1935, when the first high compression tractors were offered by a few progressive manufacturers.

There are two major reasons for this growing preference for high compression:

1. High compression tractors use gasoline—and gasoline is the choice of the large majority of farmers. Gasoline offers the farmer the conveniences of easier starting, quicker warm-up, better idling and greater flexibility than is obtainable from heavier tractor fuels. By reducing crankcase dilution, it saves both oil and money.

2. High compression tractors deliver more power from an engine of a given size. With high compression and gasoline a farmer can pull more equipment and work more acres in a day, thus effecting a sizable saving in manpower hours. In addition, high compression gets more work from each gallon of gasoline—gives maximum fuel economy.

Because of its efficiency from an engineering standpoint and its practicability as proved in ten years of farm operation, high compression will most certainly be a major factor in the design of the tractor of the future.

ETHYL CORPORATION
Chrysler Building, New York City

Manufacturer of Ethyl fluid, used by oil companies to improve the antiknock quality of aviation and motor gasoline.

NEW CONTINENTAL Tyl-Lyke

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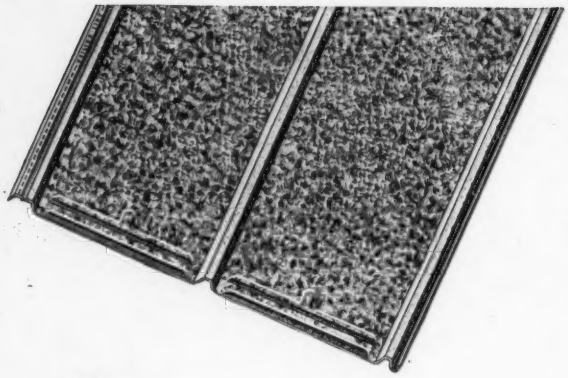
STEEL ROOFING AND SIDING



HERE'S a new steel building sheet with advanced features. Continental's new TYL-LYKE steel roofing and siding has style and strength. Its all-weather lap has a nailing line to insure proper nailing, and a new drip bead to protect against seepage. Made of special analysis steel and galvanized by the Superior Process. Your local Continental dealer may now have a supply of TYL-LYKE. See him for all your needs including fence and barbed wire. Write today for a free copy of Continental's new Farm Improvement Guide.

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CONTINENTAL STEEL CORPORATION

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PRODUCERS OF — 15 Types of Farm Fence, Posts, Gates, Barb Wire · 14 Styles of Steel Roofing and Siding, and Fittings · Nails, Staples, Lawn Fence, Wire Products

be attained without new construction if existing shelters were adequately repaired and utilized. It is just as important in peacetime agriculture to have buildings in efficient repair to reduce overhead in the cost of production.

3 Records show that over one-third of the pigs die between farrowing and market. In some of the leading hog states, over 40 per cent are lost. Much time and money has been spent to develop sows that will produce nine or ten pigs per litter. Then because of inadequate facilities three to four out of each litter die. Each pig farrowed dead represents the loss of 140 lb of feed. Each pig farrowed alive but dying at weaning time, when about ten weeks old, cost 120 pounds of feed more. During the next 8-week period of its life, feed consumption amounts to 242 pounds, and the final fattening period of 8 weeks requires about 388 additional pounds of feed, making a total of 990 pounds of feed for the hog when ready for the market. If the hog dies just before it is ready for slaughter, nearly one-half ton of feed is lost.

4 A recent story from Iowa State College tells of a group of cattle fed out in Iowa made an average daily gain of 2.47 pounds per head during the first two months on feed when lots were in good condition, then snow and rain turned the lots into mud. In the next 26 days the cattle not only failed to gain but showed a loss of 3.25 pounds a head. In those 26 days each steer consumed an average of nine bushels of corn as corn and cob meal, 26 pounds of linseed meal and 31 pounds of hay—nearly $10 worth of feed. That is in addition to the loss on the weight decrease. Agricultural engineers at the college estimated that materials for a paved yard could be purchased for approximately $4 per steer which shows that in one month's time the loss to the owner was more than enough to provide a paved lot which he could have used for a lifetime.

5 In a report compiled by the Division of Agricultural Engineering, U. S. Department of Agriculture, it is pointed out that a large per cent of man-hours of work is spent in and around buildings. For instance, 80 per cent of the man-hours of work for producing milk or poultry and eggs are spent in and around buildings.

III. What methods and procedures are necessary to coordinate these plans closely?

1 Recognizing that many extension workers have not had adequate training in farm structures, special information should be brought to them through group meetings or other effective means.

2 Extension services in certain states have performed valuable service in conducting farm building schools for building material dealers and distributors and rural builders.

3 Industry and extension workers thus informed have an opportunity to be of service in helping solve the farmer's building problem by means such as the following: Radio, plan service, weekly and farm paper stories, group planning meetings, educational material distribution, and dealer contacts.

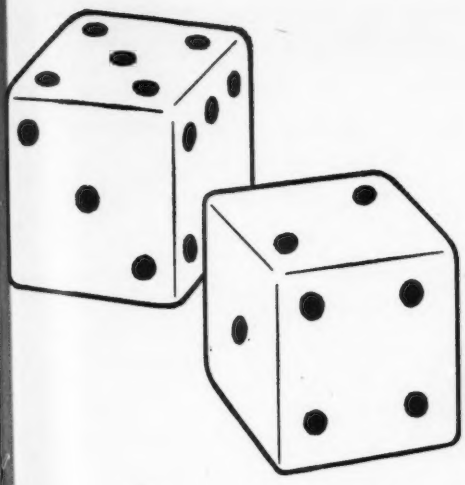
Drainage and Irrigation Recommendations

A GROUP of members of the American Society of Agricultural Engineers, representing the Society's Soil and Water Division, met at Chicago, December 11 and 12, 1944, to consider some of the major drainage and irrigation problems in the country and to propose recommendations to the Society pertinent to these two fields of agricultural engineering activity. The group consisted of Howard Matson (chairman, A.S.A.E. Soil and Water Division), Edwin Freyburger, John R. Glass, P. W. Manson, James A. Muncey, Fred F. Shafer, and Earl G. Welch, and following are the recommendations which they drafted and which have previously been mailed to A.S.A.E. members:

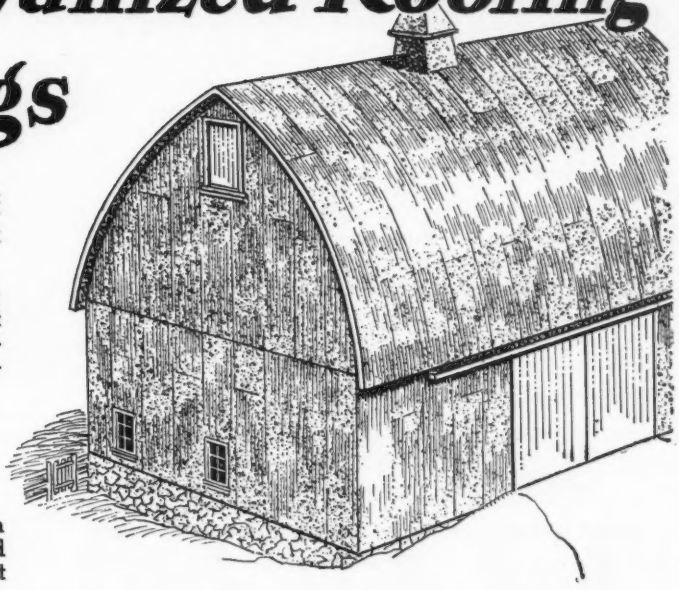
"1 This group of A.S.A.E. members recommends that the Society request the Chief of Engineers of the War Department, the Commissioner of Reclamation of the Department of the Interior, and the Land-Use Coordinator of the Department of Agriculture to issue a joint statement defining clearly and definitely the nature and scope of the authority and responsibilities of each of these agencies in connection with water problems, including flood control, drainage, and irrigation and associated activities.

"2 This group believes that there is a need for each state to centralize its responsibilities in connection with water problems in one office to act as a clearing agency for all state organizations concerned.

"3 This group recommends that the A.S.A.E. go on record as favoring the development of drainage and irrigation works as a long-time program based on national needs for food production and land-use adjustment rather than as postwar projects to use surplus labor and equipment or to develop lands for settlement. We believe that the A.S.A.E. should recommend that all proposed drainage and irrigation projects, whether they are to be financed by public or private funds, should be investigated to *(Continued on page 124)*



It's GOOD LUCK *to have Galvanized Roofing on Buildings*



For in these days of material scarcities, galvanized roofing can be taken care of by simple, easy means and made to last a lifetime.

Galvanized roofing is zinc-coated roofing; and the U. S. Bureau of Standards states that zinc is "by far the best" protective metallic coating for iron or steel! Zinc in the form of galvanizing provides double protection:

First, by simple coverage, with a sheath of rust-resistant metal.

Second, by electro-chemical action or "sacrificial corrosion."

Galvanized roofing is used on more than a third of all the farm buildings in the United States—which proves that farmers are smart judges of roofing value!

Take Care Of It!

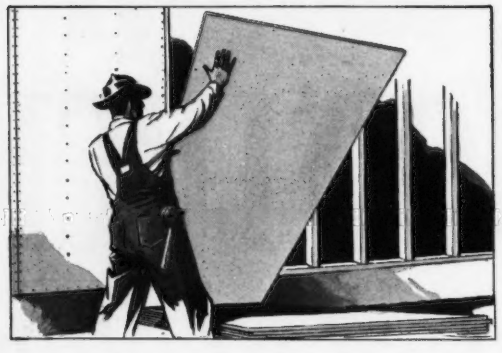
It's just good business to take good care of galvanized roofing. It is so easy to do it, too, that there's no excuse for neglect. With reasonable care, galvanized roofing can be made to give a lifetime of satisfactory service. Get a copy of the free booklet

"How to Make Galvanized Roofing Last Longer"

and the few simple steps to take will be made completely clear. The booklet is valuable. It's free—write for it today.

American Zinc Institute
INCORPORATED
60 East 42nd Street, New York 17, N.Y.

YOU BUILD STRONG FARM STRUCTURES WITH INSULITE



Here is a structural insulating board that provides important advantages in farm buildings. Insulite's advantages are many:

- *Great structural bracing strength.*
- *Low rate of heat conduction through walls and ceilings.*
- *Minimum air leakage through walls and ceilings.*

The superior qualities of Insulite have been proven in the laboratory and by actual job performance. Used in new or old construction Insulite $^{25}/_{32}$" Bildrite provides sheathing and effective insulation in one material.

Insulite buildings remain strong and rigid. The insulation provides needed animal and operator comfort as well as temperature control for product storage. It makes possible adequate ventilation.

Information on use of Insulite for Farm Buildings will be furnished upon request.

INSULITE, AE35, Minneapolis 2, Minnesota

• Insulite insulating boards are easily and quickly sawed and nailed into place. The boards are light and easy to handle. No cracks, knotholes or uneven surfaces.

• Insulite applied to the inner side of the framework completes the wall and ceiling construction, materially aiding the functioning of the ventilating system.

• Nailed to the outer side of the framework on old or new buildings, Insulite requires paint only as protection for many years of service against the elements.

MADE EXCLUSIVELY FROM WOOD

NEWS SECTION

Meek Heads Southeast Section

WILLIAM E. MEEK, special tillage and seeding machine sales representative of the International Harvester Company in the southeastern states, was elected the new chairman of the Southeast Section of the American Society of Agricultural Engineers at a meeting of the Section held at Atlanta, Georgia, February 19 and 20. At this meeting a first and second vice-chairman were also elected: H. R. Roberts, field engineer, Portland Cement Association, and Russell Woodburn, project supervisor, Soil Conservation Service, USDA, respectively. G. E. Henderson, assistant chief, agricultural engineering development division, Tennessee Valley Authority, was re-elected secretary-treasurer of the Section.

A very interesting program of papers was presented at the meeting, which was attended by about forty members of the Society, together with about half as many visitors.

A.S.A.E. Annual Meeting Cancelled

THE Council of the American Society of Agricultural Engineers has voted to cancel the Society's annual meeting scheduled to be held at the Hotel Schroeder in Milwaukee, June 25 to 27. This action was taken in compliance with the request of the federal government to cancel large gatherings of people involving the use of transportation and hotel facilities.

S.P.E.E. Meeting Cancelled

THE Society for the Promotion of Engineering Education announces that its 1945 annual meeting, scheduled to be held at St. Louis, Mo., June 21 to 24, has been cancelled in compliance with the request of the War Committee on Conventions of the Office of Defence Transportation.

Personals of A.S.A.E. Members

James T. Ashton, for several years connected with the engineering department of The Oliver Corporation at the Battle Creek works, and more recently one of the engineers of Hercules Motor Corp., was recently appointed chief engineer of the Harris Mfg. Co., at Stockton, Calif, where he will be concerned with the development and manufacture of farm machinery built for that company.

Robert I. Denny has resigned as development engineer for Wood Bros. Thresher Co., to take charge of engineering for the New Method Equipment Co., Indianola, Iowa. This company manufactures tractor-mounted hay stackers and manure loaders, also poultry pickers.

Fred W. Kernen, who has been serving with the Royal Canadian Air Force has recently been transferred to the RCAF (Reserve) and is now an instructor in agricultural engineering in the dominion-provincial youth training schools conducted under the extension department of the University of Saskatchewan at Saskatoon.

J. R. Mohlie, who has been serving as chief engineer at the Battle Creek works of The Oliver Corporation, has been advanced to the position of plant manager there.

J. A. Vorster writes that for nearly six years he has been employed by the University of Pretoria, Union of South Africa, as lecturer of agricultural engineering, and that in that period the university, which has a professional curriculum leading to a degree in agricultural engineering, has graduated ten students with that degree. During this period Mr. Vorster has also been employed by his government in agricultural engineering work of a responsible nature.

Wm. C. Wenner has resigned as associate engineer in the field operations division of the Rural Electrification Administration and has accepted the position of manager of the Delaware County Electric Co-Operative, Inc., at Delhi, N. Y.

Applicants for Membership

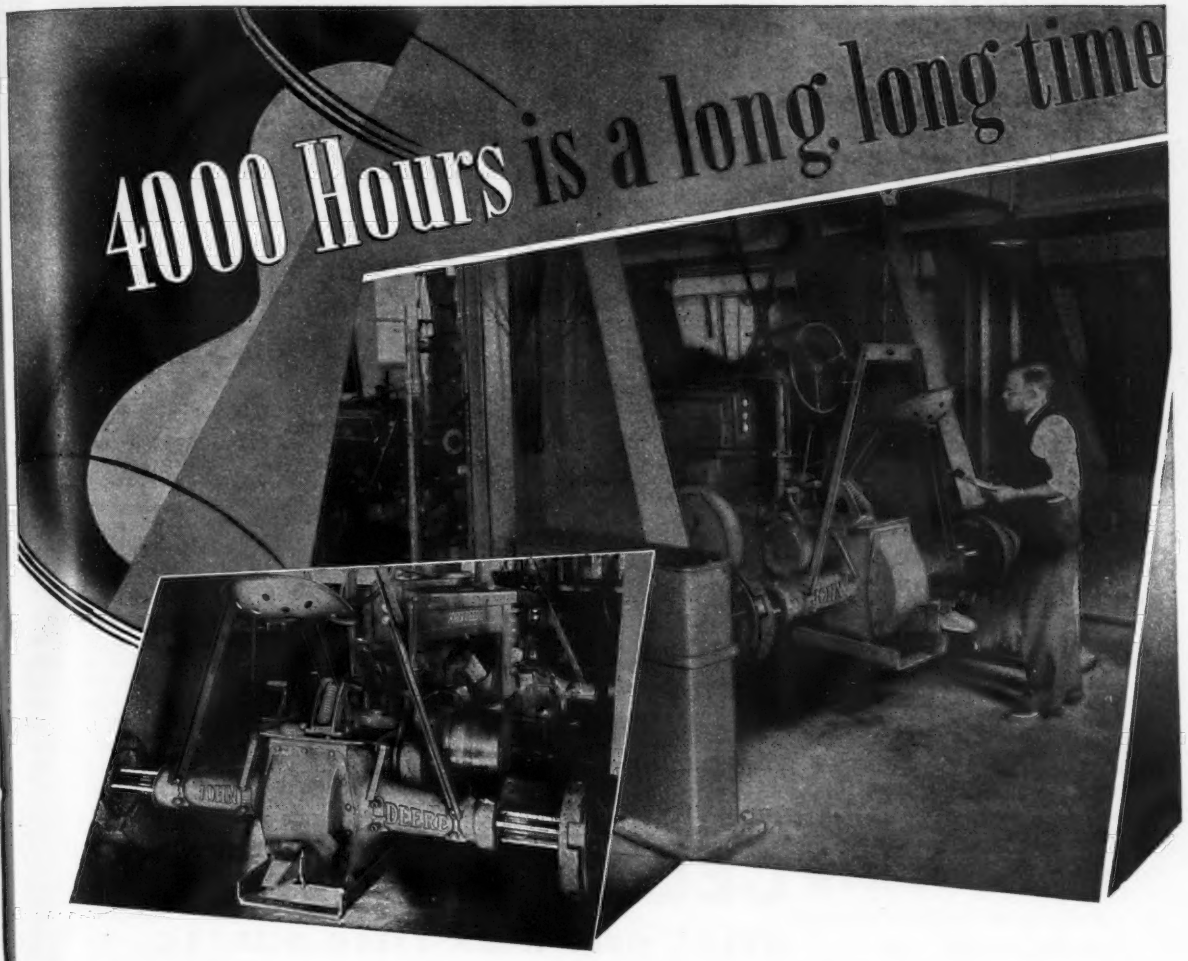
The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

William A. Anderson, rural utilization specialist, Bonneville Power Administration. (Mail) 401 Welch Bldg., Spokane 8, Wash.

A. W. Barringer, vice-president and treasurer, Turner Mfg. Co., Statesville, N. C.

(Continued on page 124)

4000 Hours is a long, long time



FOUR thousand hours is a long time to keep a tractor operating at high speed, at peak load. But, that is the break-down test new models of John Deere Tractors must pass before they are ready for production—4,000 hours without failure.

Note in the illustration above that the rear wheels of the tractors have been removed and pulleys adjusted on the axles. The belts operating on those pulleys enable the engineer to fix resistance to a point where the tractors are "pulling" against a full load. Then, with throttle wide open, they are run continuously twenty-four hours a day, seven days a week, for the full period of four thousand hours . . . more than five months.

Constant checks are made throughout the period on the horse-power developed, oil and fuel consumed, and other vital factors. Then, the tractor is torn down to determine if any excessive wear appears. When that test has been passed successfully, the tractor is ready to go into production and proudly don the John Deere name plate.

Such high requirements of perfection and durability are characteristic of the John Deere organization, which operates today on the same basis of integrity of manufacture as it did in the days when its founder said, "I will never put my name on anything which hasn't in it the best that is in me."

There is no substitute for the accumulated experience gained through more than a hundred years of single-minded devotion to the manufacture of better farm implements.

JOHN DEERE

Moline, Illinois

Applicants for Membership

(Continued from page 122)

H. W. Beaner, Turner Mfg. Co., Statesville, N. C.

Forrest G. Bell, chief, erosion control practices division, Soil Conservation Service, USDA, Room 4641, South Bldg., Washington 25, D. C.

Robert S. Calkins, agricultural engineer, soil conservation service, Pennsylvania Railroad. (Mail) Box 108, Lemasters, Pa.

Thor W. Christensen, assistant to manager, rural electric sales, Pacific Gas and Electric Co., 245 Market St., San Francisco, Calif.

A. F. Davis, secretary, The James F. Lincoln Arc Welding Foundation, 12818 Coit Rd., Cleveland 1, Ohio.

T. Karl Dimmitt, farm service director, Puget Sound Power & Light Co., Seattle, Wash.

J. P. Dodds, Lt., USN. (Mail) F.P.O. No. 100, New York, N.Y.

Henry T. Long, sales manager, Electric Equipment Manufacturers, 177 Harris St., NW, Atlanta, Ga.

Paul L. Moen, sales and engineering (farm structures), Rilco Laminated Products, Inc., W-1581 First National Bank Bldg., St. Paul, Minn.

J. Kingsley Noel, Jr., vice-president in charge of sales, Victor Products Corp., 901 Pope Ave., Hagerstown, Md.

T. Foster Rose, Lt. (jg), USNR. (Mail) Minecraft Training Center, Little Creek, Va.

R. A. Schlarb, truck and tractor tire sales dept., The Firestone Tire & Rubber Co., Akron 17, Ohio.

Wayne E. Schober, assistant chief engineer, mixer and loader division, Pioneer Engineering Wks., Inc. (Mail) 4620 Columbus Ave., Minneapolis 7, Minn.

K. W. Smith, mechanical engineer, Bennett-Ireland, Norwich, New York.

John B. Turner, general manager, Bennett-Ireland, Norwich, New York.

J. M Wagner, president and general manager, Turner Mfg. Co., Statesville, N. C.

W. A. Watts, Jr., Massey-Harris Co., Ltd., Toronto, Ontario, Canada.

TRANSFER OF GRADE

J. J. Brickley, superintendent of agriculture, United Fruit Co. (Mail) Banes Oriente, Cuba. (Associate to Member)

Wedford J. Liddell, project supervisor, Soil Conservation Service, USDA. (Mail) 150 Pine St., Spartanburg, S. C. (Junior Member to Member)

Xzin McNeal, assistant agricultural engineer, agricultural engineering dept., University of Arkansas, Fayetteville, Ark. (Junior Member to Member)

Drainage and Irrigation Recommendations

(Continued from page 120)

determine the suitability of the soils for such use and the economic feasibility of the projects.

"4 This group believes that the A.S.A.E. should recommend that feasible drainage and irrigation projects be approved and developed in the order of their importance as food production areas, considering the benefits which can be expected in relation to the cost of the work. We believe that the following order of priority should apply to drainage and irrigation work:

"(a) Projects in good condition so far as main ditches or canals are concerned but where additional farm facilities or improvement of existing facilities are needed to increase production.

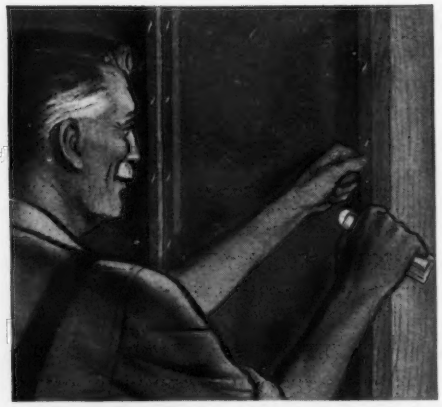
"(b) Projects now in good condition where provision for adequate maintenance is needed.

"(c) Projects needing extensive rehabilitation.

"(d) New projects where the land is suitable for drainage or irrigation and the cost of development will be low.

"5 This group recommends to the A.S.A.E. Committee on Curriculums that additional consideration be given to the need for including as many as possible of the fundamental engineering courses as required subjects or electives in the agricultural engineering curriculum. Some of the courses which are especially valuable for engineers who expect to do soil and water conservation work are Advanced Surveying (not highway or railroad), Advanced Hydraulics (including open channel flow and water measurement), Hydrology, Soil Mechanics, Geology, and Reinforced Concrete Design."

HERE'S HOW CELL-U-BLANKET
HELPS MEET HIGH YIELD QUOTAS



The farmer in 1945 is faced with the problem of meeting higher production goals than ever before—under circumstances as difficult, if not more so.

You will help the farmer to increase the yield of his animals—at no added feed cost—when you recommend that he insulate all animal shelter. Masonite* Cell-U-Blanket, when properly applied increases overall production efficiency on the farm—for these reasons:

1. It increases health and cuts mortality.
2. It increases winter production of eggs and milk.
3. It provides hot weather protection.
4. It cuts feed bills.
5. It provides milk, eggs, and pork when prices are highest.
6. Pigs grow faster—bring higher returns.
7. It makes farm work more comfortable, winter and summer.

Tests on Cellufoam, the improved cellulose fiber insulating core of Cell-U-Blanket indicate a "K" factor of .26. Its controlled density precludes sagging, packing or separating. Although flexible, it will sustain its own weight. Every inch of Cellufoam has been chemically treated to protect it against mould, rot, vermin and flame.

Because of its many advantages, Cellufoam has a number of other interesting applications in equipment for the farm.

Address all inquiries to the Masonite Corporation, Dept. AE-3, 111 W. Washington St., Chicago 2, Ill.

Convenient rolls or panels cut with true edges, apply easily.

MASONITE
CELL-U-BLANKET

REG. U. S. PAT. OFF.

*"Masonite" is a trade-mark registered in the U. S. Pat. Off. and signifies that Masonite Corporation is the source of the product.

...THE Successful FARMER

OF TODAY AND TOMORROW IS THE MECHANIZED FARMER...

FOX FORAGE HARVESTER

The FOX will mow, chop and load, in one operation, over 200 tons of grass silage a day.

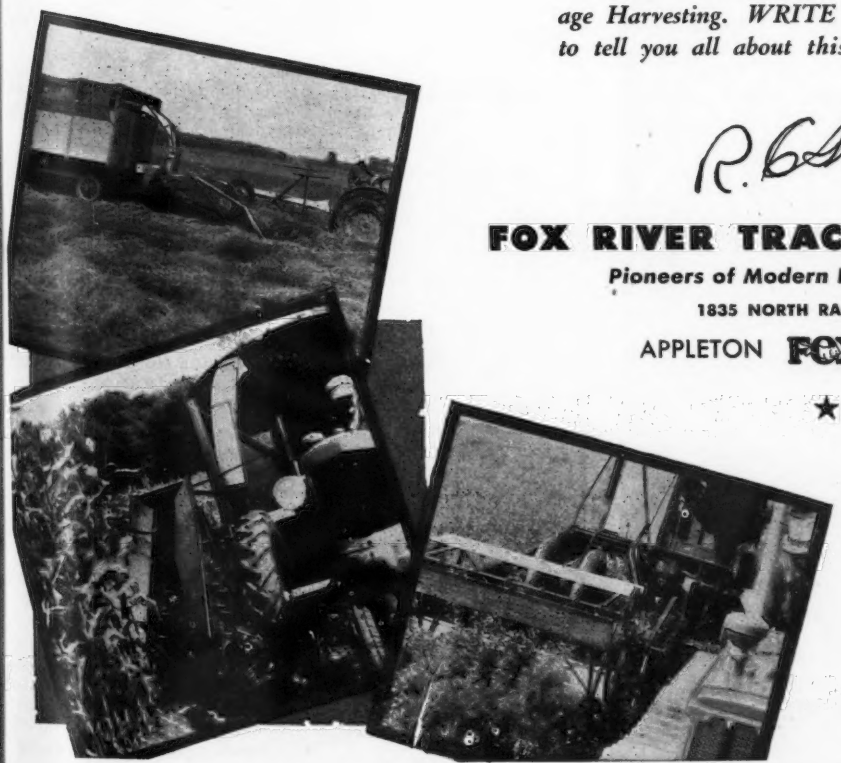
—will cut corn of any height, chop it into silage and load it into wagons ready for the silo, all in one operation.

—one man, with the FOX, can pick up, chop and load, ready for the mow or stack, 2 tons of dry hay in 12 minutes.

THE present labor shortage will not end with the War. The farmer today realizes that never again will hand method farming be profitable, and that the mechanized farm is and will be the profitable farm. To be properly mechanized, a farm must be equipped with the FOX FORAGE HARVESTER—"The Farm Machine of Tomorrow—Today."

The FOX FORAGE HARVESTER, the last word in modern farm machinery, does the three toughest jobs on the farm: Haying, Forage Harvesting and Silo-Filling.

The FOX is built by the Pioneers of Modern Forage Harvesting. WRITE US—we will be glad to tell you all about this marvelous machine.



R. C. Krueger
Secretary

FOX RIVER TRACTOR COMPANY

Pioneers of Modern Forage Harvesting

1835 NORTH RANKIN STREET

APPLETON FOX WISCONSIN

★

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The Farm Machine of Tomorrow . . . Today

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SISALKRAFT

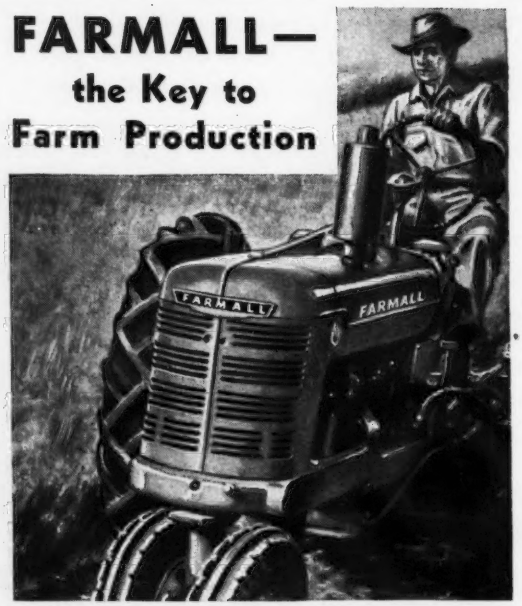
Ventilation in poultry houses is more easily controlled when walls are lined with SISALKRAFT to shut out wind, rain, cold and dirt. Machinery stored in the open is safely protected from weather when covered with weatherproof, tear-resistant SISALKRAFT. Used to bank farm house foundations, SISALKRAFT shuts out wind and cold, thereby saving fuel.

A new folder illustrating many farm uses of SISALKRAFT is available. Would you like to have a copy?

THE SISALKRAFT CO.
205 W. WACKER DRIVE · CHICAGO 6, ILL.
NEW YORK · SAN FRANCISCO · LONDON · SYDNEY

Manufacturers of SISALKRAFT, FIBREEN, SISAL-X, SISALTAPE AND COPPER-ARMORED SISALKRAFT

FARMALL—
the Key to Farm Production



Twenty-One Years Ago INTERNATIONAL HARVESTER accelerated the advance of farm mechanization with the introduction of the Farmall Tractor. Farmall was FIRST. Farmall IS first today. Look to Farmall for leadership in the great power-farming developments to come.

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue — Chicago 1, Illinois

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any Notice in this bulletin will be inserted once and will thereafter be discontinued, unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

AGRICULTURAL ENGINEERS, preferably men with some experience in farm equipment, are wanted by a nationally known manufacturer. Experience desired includes design, engineering applications, market research and merchandising. Excellent opportunity for men possessing either limited or broad experience. Salary open. Replies received on a confidential basis. Education, experience and special qualifications should be stated fairly complete in the first letter. PO-178

FARM IMPLEMENT ENGINEER AND DRAFTSMAN wanted to develop garden tractors, vegetable seeders, multiple-row cultivators, and hand and horse tools for home gardens and small growers. Position permanent. No postwar conversion. State education, experience, draft status, and salary expected. PO-177

AGRICULTURAL ENGINEER wanted. Practical man with sales experience to join large steel company entering farm building field. Dealer sales development program needs men between 28 and 42 with agricultural engineering background and proven sales record in farm equipment, building or similar fields. Excellent opportunity to get in on ground floor of promising postwar industry. Salary. In reply, give complete history of education and business experience as well as references and a small photo. All replies will be held confidential. PO-176

AGRICULTURAL ENGINEER wanted by the Allahabad Agricultural Institute, Allahabad, India, for teaching position. Minimum qualifications, degree in agricultural engineering and some farm experience. Postgraduate degree desirable. Duties would be primarily teaching, but some opportunity to participate in research and extension. Candidate must be active Christian interested in mission work. Discharged veteran with slight handicap eligible, if in good health otherwise. Applicants may correspond with Mason Vaugh, 1462 Beall Ave., Wooster, Ohio, or Board of Foreign Missions, Presbyterian Church in U.S.A., 156 Fifth Ave., New York 10, N. Y.

DISTRICT MANAGER wanted for western New York. Experience in the sale of dairy farm equipment helpful, but not essential. Must have automobile. Postwar future. Salary, expense allowance, commission, and bonus. Thorough field training, during which salary and expenses are paid. Write in detail, stating age, education, experience, and at least three character references. PO-175

RESEARCH ENGINEER wanted for work in farm structures and rural electrification in a land-grant college in a north central state. A young man is preferred. Salary will depend upon qualifications. Write giving full details of education, experience, draft status, and other particulars. PO-174

FACTORY MANAGER with agricultural engineering background wanted to take charge of a small factory producing barn equipment and hay tools. A permanent position for a man with executive ability and one who is interested in research and development. In first letter give full details as to education, experience, family status, age, etc. PO-173

SALES MANAGER wanted. An old-established, expanding company in western New York employing about 150 persons requires the services of a man experienced in the sale of farm machinery. When applying, give full details as to experience, family, salary, etc. PO-172

MECHANICAL ENGINEER and draftsman required by expanding farm machinery plant with postwar future. Please give full details as to education, experience, qualifications, draft and family status and present salary. Include photograph if possible. PO-171

SALES ENGINEER wanted for permanent position with small company producing well-accepted building material products. Substantial base salary, better than average proposition for man with liking for sales work and knowledge of building construction. Give full information on past experience and earnings expected. PO-166

(Continued on page 128)

CASE COMBINES ALWAYS KEEP BUSY

BUILT BY J. I. CASE CO.

Harvesting is a job that can be trusted only to bearings that stand up when they're needed most. Bearings such as the ones that Case uses on combine cylinder shafts to take the combined weight of the cylinder and a steady belt pull . . . to absorb shock loads resulting from wet grain . . . to insure free, easy running. Naturally, the bearings are SKF's. Years of *making* SKF-equipped machines have taught Case the value of SKF performance. Years of *selling* SKF-equipped Case combines have taught dealers the value of handling a profitable line. Years of *using* SKF-equipped Case combines and threshers have won the approval of farmers everywhere. 5707

SKF INDUSTRIES, INC., PHILA. 34, PA.

SKF

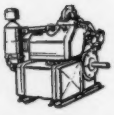
BALL AND ROLLER BEARINGS

WISCONSIN

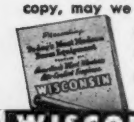
HEAVY-DUTY *Air-Cooled* ENGINES *on the job!*

HARVESTING POTATOES

Typical of the highly diversified applications of Wisconsin Engine power in agricultural service is this recently developed Potato Harvester, made by the Lindeman Power Equipment Co., Yakima, Wash.

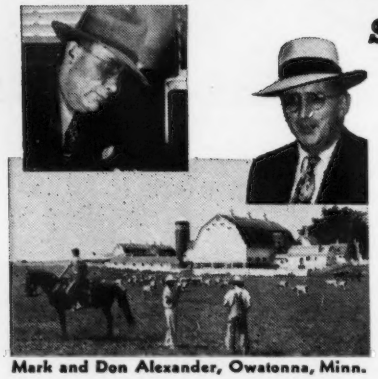


This is only one of a great many equally interesting applications which are described and illustrated in a new, condensed catalog featuring Wisconsin-powered farm equipment. If you do not already have a copy, may we suggest that you write for one without delay. Perhaps Wisconsin Air-Cooled Engines are adapted to your need, too.



WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy Duty Air-Cooled Engines

"GOOD FENCES *Sure Pay!*"



Mark and Don Alexander, Owatonna, Minn.

"It may seem like quite an expense to fence off an entire farm of 600 acres into 40-acre fields with woven wire, but we've found it pays. For with our 2600 head of hogs and 170 head of dairy cattle, along with rotated legume pasture, we've increased our crop yields 50% during the past 10 years. Corn now yields about 70 bushels per acre—before only 40. This fact speaks for itself."

New Keystone Fence Now Available

Present Keystone Fence . . . though not trade-marked "Red Brand" . . . is *tops* in quality.

KEYSTONE STEEL & WIRE CO. Peoria 7, Ill.

RED BRAND FENCE
—RED TOP STEEL POSTS—

PROFESSIONAL DIRECTORY

Consulting Engineering Work In Farm Structures Field
Also Sales Engineering for Selected Manufacturers

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Member A.S.A.E. Associated with Howard S. Sterner Company, Consulting Structural Engineers, 30 East Broad Street, Columbus, Ohio

Consulting Agricultural Engineer & Farm Market Analyst

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FELLOW A.S.A.E. — Suite 4300, Board of Trade Bldg.,
Telephone: Wabash 1558 — 141 W. Jackson Blvd., Chicago 4, Ill.

RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

EMPLOYMENT BULLETIN

(Continued from page 126)

AGRICULTURAL ENGINEER wanted by a well-known national organization to engage in sales promotion work on farm buildings, preferably someone in his early thirties with good engineering training and farm background and with plenty of initiative and ingenuity. Special training in farm buildings would be helpful to person selected. Discharged service men will receive special consideration. Write giving full details as to education, experience, etc. PO-164

POSITIONS WANTED

AGRICULTURAL ENGINEER with B. S. degree in agricultural engineering from Pennsylvania State College desires position on a farm. Experience in repairing farm machinery and capable of making improvements in machines. Two years' experience in teaching agricultural engineering at a university, and two years in managing a cooperative business. Age 27. Married, with two children. PW-369

AGRICULTURAL ENGINEER with B.S. in both agricultural and mechanical engineering from midwestern university and some graduate work in engineering, desires position in college teaching, research, extension, or with private concern. Has had experience in soil conservation, farm machinery and equipment, farm structures and rural electrification. Nine years' experience in extension, three years in teaching and research work. At present employed as a state extension agricultural engineer. Farm reared. Married. Age 40. Good reason for desiring change of position. References and professional record available upon request. PW-368

AGRICULTURAL ENGINEER, with B.S. in agricultural engineering from midwestern university, desires position in industry or in any branch of agricultural engineering, preferably in soil and water or farm structures fields. Experience in research and development in chemical soil stabilization. Recently honorably discharged from the armed forces. Married and in good physical condition. Age 23. References and professional record available upon request. PW-367

RESEARCH ENGINEER (electrical-agricultural) is available. Has a bachelor of science degree in electrical engineering (1933), master's degree in agriculture (1934), degree of agricultural engineer (1939) and is now working for a Ph. D.; also has engineering license. Temporarily employed as an extension electrical-agricultural engineer on wartime food production problems. Ten and one-half years' experience since earning master's degree in agriculture; four and one-half years' in government civil service, and five and one-half years' in other than government service. Born and reared on a farm. Thirty-four years of age, married, two children. Available at a salary range of from $4000 to $8000 per year. PW-365

Buy War Bonds!